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TOLLS ON THE ST. LAWRENCE SEAWAY

Pierre Camu, L. ès L., M.A., Ph.D.

President of the Association, 1956-57[1]

It is not an easy task to convince the taxpayer that a project of the magnitude of the St. Lawrence Waterway is good for the country and should be endorsed. One of the arguments that played an undetermined but decisive role in selling the scheme was the idea of a self-liquidating project to be paid by the users of the new waterway. In the field of navigation the question of tolls is not new. The Suez and Panama Canals are among the best known examples. Even our own canal system imposes a fee, but not a toll, the charges for each ship passing in the Welland Canal being $50.

During negotiations between Canada and the U.S.A., the question of the imposition of tolls on the Seaway was raised, considered, opposed, then accepted. Canada had already built the Welland Canal in the early thirties, and opened it without imposing a toll. But due to the high total estimated cost to complete the entire navigation phase of the St. Lawrence Seaway project, it was agreed to impose a toll system and amortize the construction costs, as well as the operation, and maintenance, of the waterway.

A six member committee, on which the St. Lawrence Seaway Authority in Canada and the Seaway Development Corporation in the U.S.A. are represented, was set up and is now studying the problem. A joint report is expected in 1958. But from various press releases it is now possible to follow, at a distance, their thinking centred around the core of the problem. This is that tolls must be high enough to amortize the project in a limited period, and low enough to attract an interesting traffic. If tolls are imposed over a period of 100 years, the committee can recommend low tolls; on the other hand if the period extends over 50 years, higher tolls must be imposed. It appears now that a fifty year period is the limit; a shorter period would even be better, due to the fact that within a half-century or less, a new canal system will be needed or the existing one doubled.

The first suggested toll structure

In 1949, five years before the project was ratified by Canada and the United States, a toll structure was prepared and suggested by the United States Department of Commerce. The suggested tolls were based on the traffic of commodities to be carried in the future canal, i.e. so many cents per ton of cargo. The potential traffic was estimated at 57-83,000,000 tons. The suggested toll charges per short ton varied between 15 cents per dead-weight ton to $1.25 for manufacturing products, and the total annual revenue anticipated was $36-48,000,000. If we use the same toll charges, but the potential traffic as estimated by the Canadian Department of Trade and Commerce of 44,500,000 tons and a breakdown of suggested tolls varying between $0.35 and $1.25, as indicated in Table 1, a total annual revenue of $26,764,000 can be collected.

With $26,764,000 annual revenue, one could pay and amortize the whole project in a relatively short period. The total cost is quite evidently not yet known. A new estimate of the total investment in navigation was prepared in 1952, but covers only the Montreal-Lake Erie sectors. Dredging undertaken in May 1957 in the connecting channels - the Detroit River, Lake St. Clair and St. Clair River - are not included in the total cost, nor is the dredging in the St. Lawrence River below Montreal. These respective undertakings are not included in this paper either; they

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[1] Presidential address delivered at the Seventh Annual Meeting of the Canadian Association of Geographers, Ottawa, Ontario, 1957.

TABLE 1

Revenue from tolls on the St. Lawrence Seaway, based on the potential traffic of commodities [1]

Commodity	Potential Traffic	Suggested Tolls, per Ton.	Total Revenue
	1000's of Tons	$	$
Iron Ore	20,000	0.50	10,000,000
Lumber	375	1.25	468,750
Pulpwood	865	1.25	1,081,250
Woodpulp	300	1.25	375,000
Paper	850	1.25	1,062,500
Petroleum & Oil Products	1,091	0.25	272,750
Hard Coal	500	0.35	175,000
Soft Coal	3,500	0.35	1,225,000
Wheat	6,000	0.35	2,100,000
Other Grain	2,000	0.35	770.000
Flour & Mill Products	2,200	0.50	1,100,000
Iron & Steel	1,586	1.25	1,982,500
Coke	200	0.35	70,000
Autos & Parts	790	1.25	987,500
Fertilizer	75	1.25	93,750
All Other	4,000	1.25	5,000,000
Totals	44,532		$26,764,000

are considered as different projects.

Hence, $14,000,000 dollars would be required each year to amortize the cost of the project and pay for its annual maintenance and operation over a fifty-year period. Let us take the round figures of an annual revenue of $25,000,000 and a total cost of $300,000,000. It would then be possible to pay off the project and liquidate the mortgage, so to speak, in half the time, in twenty-five years. After that, it would be possible to revert to a standard fee of $50 or $200 per passage per ship.

Nobody knows what the traffic will be on the waterway. The engineers, in preparing their estimates of the cost involved, made insufficient allowance concerning the dredging aspect and later found that there was less overburden and more rock at the bottom of channels and excavations, etc. Today after two years of a remarkably progressive construction program, we know that the project will cost much more than anticipated. Amortization over a 50-year period is still being considered, pushing the scale of suggested tolls much higher, in fact, almost to the point where it would be restrictive to traffic.

New toll ideas have also been introduced. Not one, but a dual or composite

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[1] Source: E.M. Capelovitch, E.M: The Economic Impact of the St. Lawrence Seaway on Canada and in particular on the Montreal area, p. 16. The table is based on another table taken from the St. Lawrence Seaway Manual, p. 70. This table uses the estimates of the U.S. Department of Commerce of 1949, ranging between 57-84 million tons.

TABLE 11

Estimated cost of the St. Lawrence Deep Waterway Project and financial charges at December 1952 cost levels[1]

Original estimated cost of navigation work.....	$174,950,000	$88,074,000	$263,024,00
Interest during construction at 3 percent	15,746,000	7,927,000	23,673,00
INVESTMENT IN NAVIGATION	190,696,000	96,001,000	286,697,000
Annual charge for amortization over a 50 yr. period and interest at 3%	7,418,000	3,734,000	11,152,000
Annual maintenance and operation	2,000,000	1,460,000	3,460,000
ANNUAL CARRYING CHARGE	9,418,000	5,194,000	14,612,000

toll structure, is now being discussed.

The latest suggested toll structure

The veil is partly lifted on a new formula in a recent Press release[2]

"The toll committees of the Canadian and American Seaway Authority have been exploring various bases for assessing tolls with a view to developing a formula to achieve the following objectives:-

1. Procedural simplicity which will minimize the cost of collection and expedite the dispatching of vessels.

2. Recovery of the cost of the Seaway and its operation on a basis that will provide for economical rates to users and will encourage traffic.

As a result of their studies of the toll structures of other international waterways and of pertinent maritime rules and practices, the committees have under consideration a composite basis of toll assessments as being most suitable to meet the above-mentioned requirements. Such a toll structure would encompass an assessment per ton of cargo or its equivalent, together with an assessment on a vessel's registered tonnage.

The committees are pursuing their studies of traffic factors and other element involved in the development of a tariff of toll rates within such a toll structure. In this connection the committees will continue to obtain the views of prospective users of the Seaway."

The new element is the double assessment, or two tolls, the first one on the

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[1] Source: St. Lawrence Seaway Manual, p. 69.

[2] The St. Lawrence Seaway Authority, Press release no. 163, May 15, 1957.

cargo, the second on the registered tonnage. Such a system would not be in line with objective 1, stated above. Indeed, such a system is far from being simple, it is more complicated. Let us compare it with the system used for the vehicular traffic on bridges near Montreal.

In the Montreal area, the Victoria and Jacques Cartier bridges have an identical toll system of 25 cents per automobile including the driver, and 5 cents per extra passenger. The result is time-consuming and adds to traffic congestion, but more revenue is collected than would derive from a flat toll of 25 cents per automobile, irrespective of the number of passengers. These bridges are indispensable between Montreal, the South Shore, and the roads leading to U.S.A. points. Drivers cannot boycott these two bridges. The only alternative is another bridge located several miles to the southwest, which would involve a considerable loss of time. Is the application of the new toll structure to the waterway comparable? Not quite so. Evidently, two tolls are more complicated than just one, but the objective of recovering the cost of the Seaway remains. The new waterway offers, for the majority of vessels operating in the St. Lawrence as far as Montreal, a new route which they may or may not use. The potential cargo available at Great Lakes ports is a temptation, and, with competition, the direct traffic between the Great Lakes and other ports of the world will certainly increase. If the users do not object to such a system, (and it seems that they do not), the remaining problem is to determine the dual toll structure.

In an informative letter[1] received recently, the dual or composite toll structure is "predicated on the desirability from the operators' point of view of segregating the operating and maintenance costs from the amortization features". Let us refer again to the separate items for amortization and maintenance and operation in Table 11 and keep these in mind as the letter continues:

> "A first toll would be based on some measure of a vessel's earning capacity which would represent an adequate return to the authorities of the cost of maintenance and operation; such costs should not be difficult to estimate reasonably accurately. If the vessel owner or operator absorbed these costs in his freight rate structure (it would of course ultimately be passed on to the shipper) it could not be said that the vessel was getting a free ride.
>
> The second toll, which would be a direct charge on the cargo and paid by the vessel on behalf of the shipper, should clearly reflect the amounts required for interest and amortization of the capital cost. This feature of the toll structure is bound to vary according to the political atmosphere of the moment and could easily be geared to what the traffic will bear. It would, I think, be always subject to debate. Competing transportation interests will want this factor to be as high as possible: other interests will want it low. Its principal merit is that it will take the ship operator out of the inevitable controversy, which I feel would be the most desirable position, for the operator. Furthermore, I think there are good grounds for arguing that the capital cost to be recovered might well be reduced to reflect some measure of the financial help other competing mediums have already or are receiving from the State."

Can such a dual toll structure be applied?

The question at this point is: Can any tolls structure be determined with the rising costs of construction?

The estimated total cost of $300,000,000 to build the Seaway has increased

[1] Letter from Mr. W.J. Fisher, General Manager, Canadian Shipowners' Association, dated May 16, 1957.

tremendously. It may reach half a billion dollars ($500,000,000) - the cost of operation of the memorable Berlin Airlift during six months. It appears that the toll system should not be determined by the total cost, but by the tonnage and traffic of the first year of operation. But let us examine how a dual toll system could be applied by assuming (1) the same potential tonnage of 44,000,000 tons of cargo which, incidentally, is the potential tonnage of the Welland Canal (45,000,000 tons) the limiting sector of the new waterway when completed, and (2) a revised estimated cost and new financial charges at the end of 1956 cost levels as follows:-

Investment in navigation including interest during construction (Canada and U.S.A.)	$500,000,000
Annual charge for interest and amortization at 3.5% for both countries over a 50-year period	21,316,855 [1]
Estimated annual maintenance and operation	5,000,000
Estimated annual carrying charges	26,316,855

The Toll on Ships

The first toll of the dual toll system could be based on the gross or net registered tonnage of ships[2] and should be calculated in order to pay for the annual operating and maintenance cost of $5,000,000. If we assume a traffic of specialized ships only, the upper lakers for instance, then, to carry 44,000,000 tons, it would require 2,200 trips, with a 20,000-ton load each time. This means that each ship should pay approximately $2,272 per trip; if we divide this amount by a net registered tonnage of 7,800 tons, it gives a toll of 29 cents per ton, but if we take the gross tonnage of 12,700 tons for the same ship, it gives a toll of 17 cents per ton.

But the route will not be used exclusively by lakers. It was estimated a few years ago that 75% of the traffic would be in lake-type vessels satisfactorily accommodated by the 27-feet channel; thus only 25% of the traffic is subject to movement of sea-going ships[3] which further complicates the calculation.

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[1] Estimated by Professor McDougall of Queen's University. Using the formula $\frac{1}{\frac{(1+i)^n - 1}{i}}$ where n = 50 years; i = the rate of interest at 3.5%.

[2] The terms gross and net tonnage refer to space measurement, 100 cubic feet being called 1 ton. Gross tonnage is the capacity of the entire space within the frames and the ceiling of the hull, together with those closed-in spaces above the deck available for the cargo, stores, passenger or crew, with certain minor exceptions. Net registered tonnage is what remains after deducting from the gross tonnage the spaces occupied by the propelling machinery, fuel, crew, quarters, master's cabin, and navigation spaces. It represents space available for cargo and passengers. Dead weight tonnage is the weight in long tons required to depress a vessel from high water line (that is, with only the machinery and equipment on board) to load in. It is therefore the weight of the cargo, fuel, etc., which a vessel is designed to carry with safety. (Statistical Year Book of the U.S.A. 1955 ed.)

[3] St. Lawrence Seaway Manual. p. 75.

TABLE 111

Potential tonnage and numbers of trips on the St. Lawrence Seaway

Potential cargo tonnage	Deadweight tonnage per trip	Required number of trips	Required amount of money needed annually for maintenance and operation
33,000,000 t. (by lakers)	20,000 t.	1650	
11,000,000 t. (by ocean-going vessels	9,100 t.	1250	
44,000,000 t. (total)		2900	$5,000,000

It means that the St. Lawrence Authority should collect:

(a) $5,000,000 ÷ = $1,720. per trip

If we divide $1,720. by the net registered tonnage of a typical ore carrier on the Lakes - 7,800 NRT - and a typical ocean-going vessel of 3,080 NRT, we should be able to determine the toll in cents per ton.
For instance:

Upper laker	NRT	- 7,800 t.
Ocean-going	NRT	- 3,080 t.
TOTAL	NRT	- 10,880 t.
Average	NRT	5,440 t.

(b) $1,720 ÷ 5440 = 31.6 cents per NRT

If we assume a toll of 32 cents, the Authority would be able to collect:

(c) 1650 trips by lakers of 7,800 t. at .32 = $4,118,400
1250 trips by ocean-going
of 3,080 t. at .32 = $1,232,000
TOTAL TOLL COLLECTED $5,350,400

The Toll on Cargo

The second toll could very well be based on the suggested tolls of Table 1, cut however by 20% in order to recover $20,000,000 instead of 25,000,000 annually, since the first toll is assessed to recover the operation and maintenance costs ($5,000,000).

The basic factor to be considered is the potential tonnage during the first year's operation. The estimate used in the first part of our discussion was the estimate of the Canadian Department of Trade and Commerce (44,500,000 tons). It was revised

TABLE IV

TABLE IV

ESTIMATES BY COMMODITIES OF U.S. - CANADIAN COMMERCE ON COMPLETED SEAWAY[1]

(In Thousands of Short Tons)

Commodity	Average for 1950-54	James C. Buckley, Inc. 1959	St. Lawrence Seaway Development Corporation 1959	Canadian Department of Trade & Commerce	Great Lakes St. Lawrence Assn.	U.S. Dept. of Commerce	
						Min.	Max.
Coal and Coke	1,646	4,000	3,700	4,200	6,000	4,000	4,000
General Cargo	1,362	6,400	6,400	9,876	5,700	11,038	11,038
Grain	3,481	7,500	12,100	8,200	10,000	6,500	11,500
Iron Ore	216	8,100	10,500	20,000	20,000	30,000	37,500
Nonferrous Ore	77	500	800	-	1,000	240	240
Petroleum and Products	1,547	2,500	2,300	1,091	2,000	6,000	20,000
Wood Pulp and Pulpwood	550	1,000	700	1,165	1,000	-	-
TOTAL	8,879	30,000	36,500	44,532	45,700	57,778	84,278

[1] Source: Hartley, J.P.: The Effects of the St. Lawrence Seaway on Grain Movements, Bureau of Business Research, Indiana University School of Business, Report No. 84, 1953, p. 93.

downwards to 31, 000, 000 tons in April, 1955. The estimate given is for the St. Lawrence canals (the Montreal-Lake Ontario sector only) and cannot be applied to the Welland Canal sector. Another estimate should be used for this second sector, then an average for both determined. Only the first sector is examined here.

Table IV gives the estimates of the potential cargo tonnage about 1959, as compared to the average for 1950-1954.

Of the several estimates given in Table IV, combining the lowest tonnage for each group of commodities, leaving aside the estimate of the U.S. Department of Commerce, gives a potential average tonnage of 27, 200, 000 tons. Our own estimate today would be around 25, 600, 000 tons.

We concur with the following estimates of the St. Lawrence Seaway Development Corporation: 3, 700, 000 tons of coal and coke, mostly downbound from Lake Erie Ports to St. Lawrence River ports,[1] 6, 400, 000 tons of general cargo distributed among the Great Lakes ports as points of origin and destination; 800, 000 tons of non-ferrous ores and 700, 000 tons of wood pulp and pulpwood. With the building of pipelines, the traffic of petroleum products is going to decrease to 1, 000, 000 tons, rather than increase to 2, 000, 000 tons. As far as grain and iron ore are concerned, we estimate the first at 7, 000, 000 tons and the second at 6, 000, 000 tons. A word of explanation is needed.

Grain Traffic (Figure 1) In 1953, a record year, 15, 300, 000 tons of grain were carried downbound in the Sault Ste. Marie Canal. At Welland Canal, only 5, 500, 000 tons of grain continued to be carried downwards. In the St. Lawrence canals, the movement of grain downbound was 4, 300, 000 tons.

The explanation of the difference between the two tonnages is as follows. Several million tons of grain are unloaded at various Great Lakes ports for local consumption (3, 500, 000 tons approximately); another 2, 500, 000 tons are transferred into trains at Great Lakes ports for shipment via Atlantic U.S. ports; finally several million tons are transferred into trains at the Georgian Bay ports (3, 300, 000 tons). With the completion of the Seaway, it will be cheaper to move the grain all the way by water, via the St. Lawrence; thus the 2, 500, 000 and 3, 300, 000 tons transferred into trains, will likely continue downwards by ship to the ports of the lower St. Lawrence River. Instead of 4, it could be as much as 9 to 10, 000, 000 tons of grain that will be carried in the new waterway.

Early in 1957, Dr. Joseph R. Hartley published a very challenging study.[2] Its conclusion strengthens our view. "A volume of 7, 000, 000 tons (of grain) is possible in 1959, the first year of operation. The low and high projections are 350 and 400, 000, 000 bushels respectively.[3] Converted in tons, this means a volume of 11 to 13, 000, 000 tons in the future canals, including a sizeable diversion of American winter exports of 1, 000, 000 tons. Since the year 1953 was an exceptional year, let us take the average for the period 1953-1956. The average movement of grain downbound at the Soo is 10, 500, 000 tons. Less a regular diversion for local consumption of 3, 500, 000 tons, this gives a potential traffic for the St. Lawrence canals of 7, 000, 000 tons, if the grain continues its way downwards by water.

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[1] An excellent reference to the traffic on the Great Lakes-St. Lawrence Seaway is The Canada Year Book, 1956 edition, pp. 821-829.

[2] Hartley, J.R.: op. cit. Report no. 84, 1953. 252 pp.

[3] Ibid, p. 220.

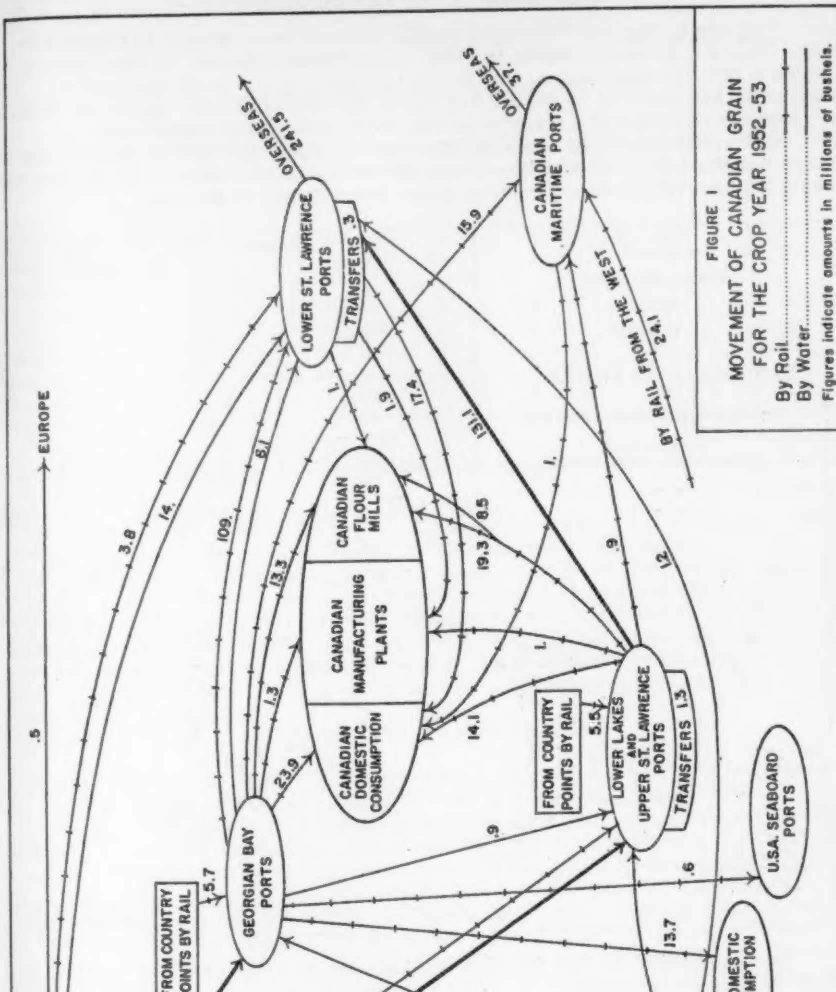

FIGURE I
MOVEMENT OF CANADIAN GRAIN FOR THE CROP YEAR 1952-53

Iron ore traffic is a "through" traffic between Seven Islands and Lake Erie ports. Figure 2 shows the traffic in 1956. Out of Seven Islands: 12, 500, 000 tons of which 6, 500, 000 tons went by ship direct to Atlantic Coast ports (especially Baltimore): 500, 000 tons to Europe and 3, 500, 000 tons via the St. Lawrence Waterway, with the exception of a transfer to rail of 475, 000 tons at Contrecoeur.

Ore production could reach 20, 000, 000 tons a year by 1959 or 1960. If so, we contend that the 1956 pattern will be repeated with 6, 000, 000 tons via the St. Lawrence, 12, 000, 000 tons via the Atlantic ports, and 2, 000, 000 tons to Europe.

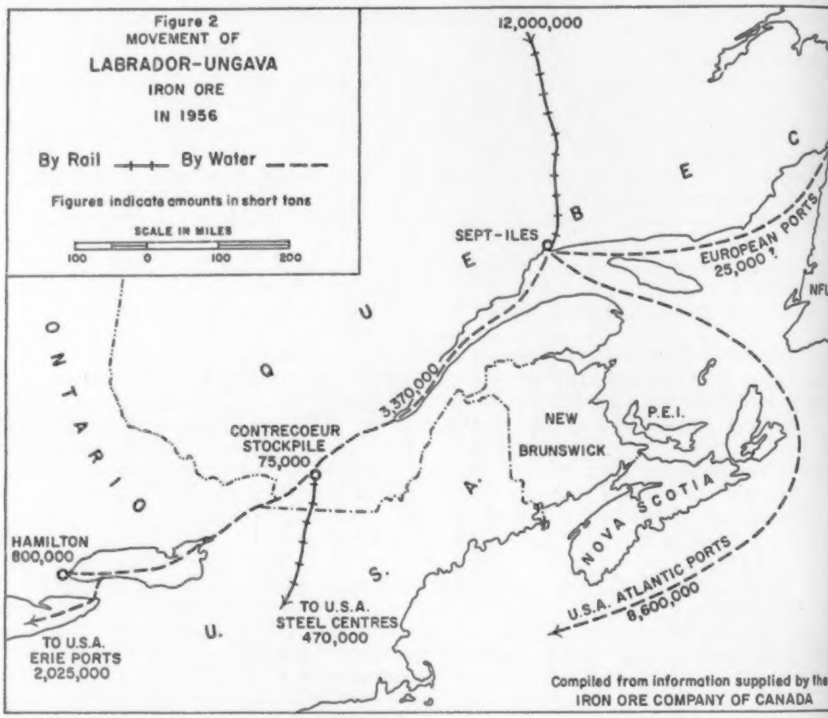

Figure 2
MOVEMENT OF
LABRADOR-UNGAVA
IRON ORE
IN 1956

Our estimate of 25, 600, 000 tons of commodities to be carried in 1959, brings us back to simple arithmetic.

The annual revenue would amount to $12, 900, 000 in 1960, by using the scale of tolls of Table 1, reduced by 20%. This means a 50 cent average toll per ton of cargo, and an insufficient revenue to amortize the project in 50 years.

We have not studied the effects of such a toll on the existing freight rate structure. Will it still be cheaper to carry goods and commodities from and to the lakes by water all the way? It would appear so. It appears also that the dual toll system can be applied, but will not be sufficient in the first years of operation to cover the annual carrying charges.

It is of prime importance to minimize collections in the first years of Seaway operation, and increase tolls with a growing traffic.

TABLE V

Potential tonnage and revenue in 1959

Commodity	Potential tonnage	Est. Toll	Revenue
		$	$
Coal and Coke	3,700,000	0.28	1,036,000
Non-ferrous ores	800,000	0.20	160,000
Pulpwood & Woodpulp	700,000	1.00	700,000
Petroleum prod.	1,000,000	0.20	200,000
Grain	7,000,000	0.28	1,960,000
Iron ore	6,000,000	0.40	2,400,000
General cargo	6,400,000	1.00	6,400,000
TOTAL:	25,600,000		12,856,000

Restrictions to the application of any toll system.

We have been dealing so far with a simplified system in a simplified manner. There are some points that will infinitely complicate the toll problem.

One of these points is the difficulty of breaking the vicious circle: Tolls - Traffic - Traffic - Tolls. One can present a potential estimate of the traffic in order to determine the tolls. Once tolls are established, they can restrict or increase the estimated traffic. One way to break the circle is the direct approach, i.e., to estimate the potential traffic as resulting from the opening of a free waterway. Two other factors are known-: the construction costs and the costs and the time required to recover.

Other points can be summarized in specific queries:

1. The tonnage increase will not occur overnight. There will be a gradual increase. With an annual tonnage of 11,000,000 tons in the existing canals in 1958, one cannot expect a 45,000,000 ton traffic in 1959 the first year of operation of the new waterway. Then we may ask this question. Will the toll structure be flexible? Should there be a very low scale for the first seasons of navigation to attract traffic, and an increasing scale afterwards? Could this be based on an actuarial system established in such a way that during the period 1960-1965, the annual revenues might be only $5 - $10,000,000 increasing gradually to more than $25,000,000 after 1975 until the end of the 50 or 40-year period needed to recover the cost of the project? The answer seems affirmative. In connection with this aspect we refer to the St. Lawrence Seaway Manual which develops this point.[1]

A system, flexible from year to year, is desirable. The growth of the Canadian economy and competition from other modes of transportation will force, from time to time, anyway, a series of adjustments.

2. Will the system have a regional application? Will there be one toll for the entire route and a fractional toll for each section? If, for instance, a laker is using only the Welland canal, will the steamship company pay for that portion only? The answer must again be affirmative. How can a ship be charged the full rate, if it uses only one section? Any other procedure would restrain traffic. An ore carrier sailing

[1] The St. Lawrence Seaway Manual, pp. 71 paragraphs 2 & 3

between Duluth and Hamilton and using only the Welland Canal (fee of $50.00 per trip today could hardly be expected to pay $2, 000 - $3, 000 for the whole waterway.

It seems obvious that there will be a scale of tolls for the entire waterway divided proportionally according to nautical miles, or according to number of sectors used. For instance, if the toll is $2, 000 for the whole waterway from Montreal to Port Colborne, it might be only $1, 000, 000 for Montreal to Cornwall. This is not going to simplify the system which has been stated as objective number. It might be remembered here that the system used on toll roads is on a mileage basis.

The regional application of the toll system is a source of conflict between the two Authorities. By imposing a toll on the Welland Canal, the U.S.A. may retaliate and impose a toll in the connecting channels.

3. Will there be one or two organizations to collect tolls? It is to be hoped that both countries will agree to set up only one organization, located and administered preferably in Montreal, the transition point between inland and oceanic navigation, the ideal transhipment center, and the entrance and exit of the whole system. I fear that the answer may be negative. We may witness two collectors instead of one at strategic points to represent the two national Authorities. If both countries decide upon a dual organization to collect uniform tolls, then the Canadian Authority will collect tolls for sections of the waterway located within its territory, and likewise for the U.S.A.

4. What about tolls on the sections of the old waterway that will remain open? The Lachine Canal in the Montreal area raises a problem. It will remain open after 1959 and for several years to come. It is the artery of the most important industrial zone of Montreal; at least 2, 400, 000 tons of commodities were loaded and unloaded on its banks in 1955. Ships will continue to use it; since most of these ships come and go to upstream ports, they will switch to the new waterway at Beauharnois. And what about the Soulanges Canal? Will it be completely abandoned? It seems so. But for the Lachine Canal and other similar sections, there should be no tolls, just a fee.

Conclusion

The problem of tolls on the St. Lawrence Seaway has been referred to by someone as a "ticklish" job, and perhaps the most complicated part of the whole project. Let us hope that the determination of tolls will not restrict but increase the inestimable services that such a great waterway can render.

RAILWAY FREIGHT TRAFFIC IN NEWFOUNDLAND[1]

Charles N. Forward

Geographical Branch, Dept. of Mines and Technical Surveys

The railway in Newfoundland plays a most important role in the economy of the island. It provides freight services for many of the major industries, handling large quantities of pulpwood, ores, newsprint, gasoline, and other commodities. It is the purpose of this paper to examine the volume and nature of freight carried as well as the physical condition and function of the railway. The variations in freight traffic density along the route and seasonal variations in volume of specific commodity shipments will be investigated. An attempt will be made to indicate the competitive position of the railway compared with other carriers.

The Newfoundland railway winds westward from St. John's to Port aux Basques via a route that carries it far northward in a great loop. The total mileage of this main line is 547 and there are 158 additional miles of branch lines connecting the main line with Argentia, Carbonear, Bonavista and Lewisporte. The track is narrow gauge 3' 6" as compared with the standard gauge 4' 8½" of mainland Canadian and United States lines. Excessive grades and curves which increase the cost of operation are handicaps that must be contended with. The original construction of the roadbed was carried out to meet a rahter low standard. Most bridges and culverts were built of wood and have had to be replaced with concrete structures. There are numerous physical disadvantages that have hindered the economic operation of the railway throughout its history.

Historical Development

The railway in Newfoundland has experienced a troubled history since the beginning of its construction in the 1880's. The sparse population scattered in widely separated pockets of settlement could be served only by a railway that traversed great distances through rugged and inhospitable terrain. Financial support of construction was obtained only with difficulty, but the railway was looked upon as a necessity and the obstacles were surmounted one by one, resulting in its completion in 1896. During the first quarter century the railway company had difficulty in operating the system profitably and by 1923 was forced to sell its assets to the Government of Newfoundland. By this time the company was operating eight coastal steamships as well as the railway and these also were taken over by the government. The publicly-owned Newfoundland Railway was then established to operate both the railway line and the coastal steamships.

Financial problems continued in succeeding years. During the next two decades until 1940 the Newfoundland Railway generally showed a deficit on its year's operations running into many thousands of dollars. Nevertheless, the services were still maintained and the government absorbed the losses incurred. Throughout the war years, however, the railway experienced a tremendous demand for its services, occasioned particularly by the construction of American military bases, and produced a substantial surplus in each year of operation. Capital expenditures were made possible during World War II by the increased revenues and the railway ended the war with better equipment than it had at the beginning. After the war until 1949 the pattern of revenue and

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[1] Presented at the Seventh Annual Meeting of the Canadian Association of Geographers, Ottawa, 1957, and published with the permission of the Director, Geographical Branch, Dept. of Mines and Technical Surveys.

expenditure reverted to that prevailing before the war and large deficits were tabled each year. Then in 1949 when Newfoundland confederated with Canada the railway was incorporated in the Canadian National Railways system. Since that time it has been considerably improved, most notably in the recent complete dieselization of the division.

Volume of Freight Traffic

Regular freight services are maintained from St. John's to Port aux Basques and vice versa. Across Cabot Strait a daily ferry service is operated between Port aux Basques and North Sydney. At North Sydney connection is effected with the mainland lines of the Canadian National Railways. The efficiency of the ferry service will be greatly improved when the new car ferry "William Carson" is placed in service between these ports.

The whole route from North Sydney to St. John's is considered an all-rail-route as far as freight rates are concerned This is a concession that was included in the terms of union between Newfoundland and Canada. As a result of this change in freight rate structure, there was an increase in volume of freight moving to the Newfoundland division of the railway after 1949. Freight which entered Port aux Basques from North Sydney in 1948 amounted to approximately 65,000 tons, while by 1952 it had risen to about 100,000 tons, and by 1954 had reached 123,000 tons.[1] Also, the fact that Newfoundland was included behind the Canadian tariff structure after 1949 caused a great increase in imports from the Canadian mainland and a decrease in imports from the United States and Great Britain. Furthermore, an increasing volume of freight has originated in Newfoundland since confederation. In 1948 the total freight forwarded from Newfoundland stations was 790,833 tons, while in 1954 it amounted to 1,147,987 tons.[2] Thus, the railway has been attracting an increasing amount of freight and has had to expand its facilities in order to handle the greater load.

The railway encounters very strong competition from steamships. The great amount of handling and transhipment involved along the rail route from Canadian mainland points to St. John's often leads to breakages and delays. Shipment of freight from Montreal to St. John's by the rail route takes three to four weeks, while steamships move freight between these points in five or six days. During the St. Lawrence River shipping season the Canadian National Railways applies a lower freight rate to meet the all-water-route competition. On the other hand, the all-rail freight rate is reimposed at the non-competitive level during the closed navigation season in winter.

Density of Freight Traffic

Based on data supplied by the Dominion Bureau of Statistics, a map of railway freight traffic density in 1954 was prepared (Figure 1). The density is shown in thousands of tons per mile of road operated, both eastbound and westbound. Of the total tonnage of freight that was landed at Port aux Basques from North Sydney by the C.N.R. in 1954 (123,698), about 6,000 tons was moved eastward to numerous south coast points by the C.N.R. coastal steamships. The remaining 117,000 tons moved by rail

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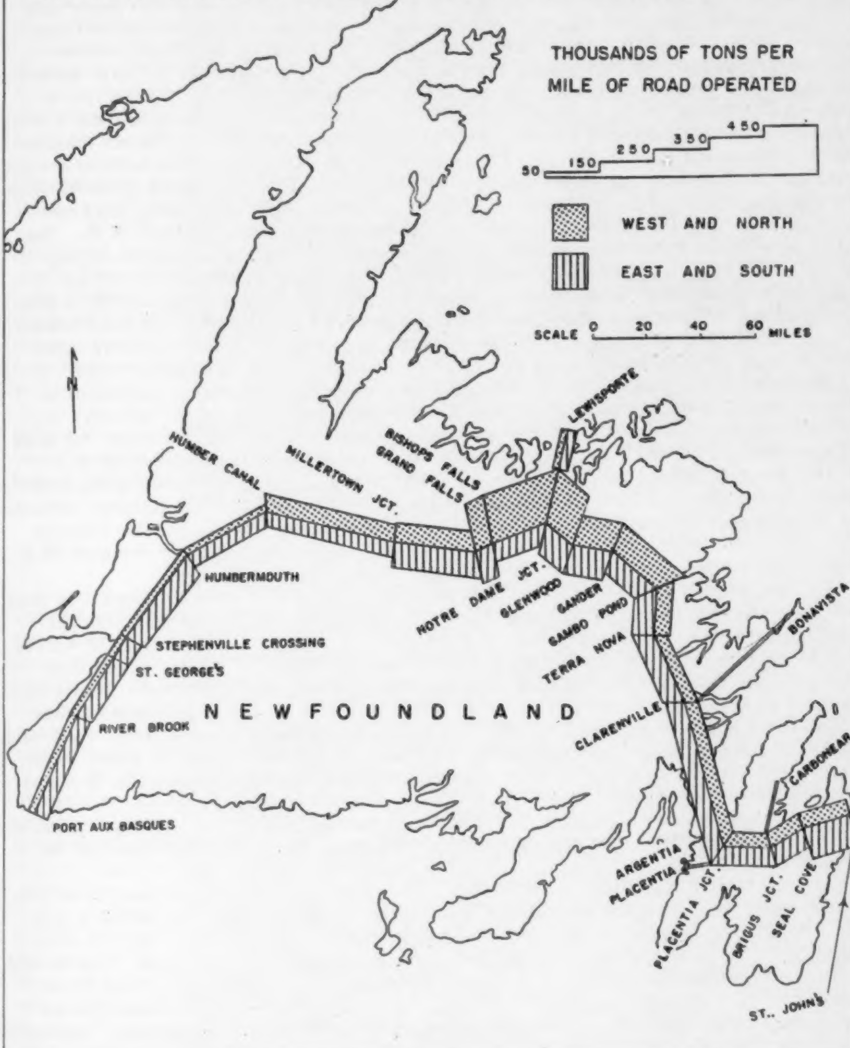
[1] Submission to the Royal Commission on Coasting Trade, Vol. 2, Ottawa, 1955 (B56 p. 19)

[2] Ibid., p. 20.

FIGURE 1 RAILWAY FREIGHT TRAFFIC DENSITY IN 1954



eastward to various Newfoundland stations. Although it is impossible to determine the exact volume of through traffic, it is likely that a substantial amount of freight continued eastward to St. John's. It is readily apparent in figure 1 that the freight density is more even in the eastbound flow of traffic than in the westbound movement.

The eastbound freight density increases from Port aux Basques along the west coast as far as Corner Brook. Large shipments of pulpwood to the paper mill at Corner Brook from several west coast stations are responsible for the increase. The two stations shipping the largest quantity are St. Fintan's and Stephenville Crossing. From Corner Brook to Humber Canal the freight density is lower again because the pulpwood has been unloaded. The freight movement in this section is made up of through traffic and additional "less carload tonnage" shipped from Corner Brook together with substantial quantities of cement shipped eastward from Humbermouth. The next leg from Humber Canal to Millertown Junction has a similar freight density. At Millertown Junction the density of freight traffic increases greatly. This increase is accounted for by the large quantity of zinc, lead, and copper ores and concentrates from the mine at Buchans that is transferred here to the C.N.R. The ore is carried 37 miles from Buchans to Millertown Junction on a private railway owned by the Buchans Mining Company. The C.N.R. carries the ore as far as Bishops Falls where it is transferred to another private railway owned by the Anglo-Newfoundland Development Company and operating between Grand Falls and Botwood.

The density of freight traffic is increased again at Grand Falls where newsprint is loaded for shipment from St. John's when the port of Botwood is closed by sea ice in winter. The density between Bishops Falls and Notre Dame Junction is reduced owing to the transfer of ores and concentrates to the A.N.D. railway. At Notre Dame junction substantial tonnages of aviation gasoline join the main line from the Lewisporte branch, thereby accounting for the increased traffic between this junction and Gander. Lewisporte has facilities for handling large ocean-going tankers. Gander International Airport is a refuelling stop for many of the transatlantic airlines and experiences extremely heavy air traffic. From Gander to Clarenville there is little change in the freight traffic density, although small amounts are dropped off at various settlements along the route.

Eastward from Clarenville the density becomes lower and remains fairly even from there to Seal Cove. From Clarenville there is a small movement of freight along the branch line to Bonavista. At Placentia Junction another branch line serves the town of Placentia and the United States Naval Air Station at Argentia. A third branch line in this area begins at Brigus Junction and serves Carbonear. These three branches carry insignificant quantities of freight when compared with the main line. At Seal Cove where the freight density increases, large tonnages of gravel, sand, and crushed stone are loaded and carried to the Concrete Products plant at Mount Pearl, a few miles outside St. John's. The remainder of the freight movement in this section, amounting to approximately 120,000 tons, continues to St. John's. This is virtually the same as the tonnage despatched eastward from Port aux Basques, but of course the through traffic represents only a part of the total and its percentage is difficult to ascertain.

The freight movement westward from St. John's is of greatest density in the central section of the route and is less at either end, especially in the western section. Westbound shipments from St. John's amount to approximately 120,000 tons, similar in amount to that entering St. John's in the eastbound movement. The freight traffic density declines gradually westward from St. John's as far as Terra Nova because more freight is dropped off at numerous settlements between these points than is taken on. Small tonnages move along the branch lines to Carbonear, Placentia, and Bonavista. At Terra Nova and stations westward large quantities of pulpwood are loaded for the pulp and paper mills at Grand Falls and Corner Brook. The tonnages increase westward from 34,000 at Terra Nova to 185,000 at Glenwood. From Notre

Dame Junction a moderate tonnage of general freight is shipped to Lewisporte for distribution along the northeast coast by boat. In addition, the volume of pulpwood moving to Grand Falls is increased by loadings at Notre Dame Junction.

At Grand Falls the density of freight traffic drops greatly with the unloading of pulpwood at the paper mill. Nevertheless, a substantial quantity of pulpwood continues westward to Humber Canal for the Corner Brook mill. Most of this pulpwood originates in the Glenwood area where both companies are cutting. A small tonnage of freight is transferred at Millertown Junction for shipment to Buchans. At Humber Canal the pulpwood is dumped in the water and moves through the Humber River to Corner Brook. Consequently, the freight traffic density is much less west of Humber Canal and remains relatively even all the way to Port aux Basques. A great part of the freight movement in this section is through traffic and only small tonnages are either loaded or unloaded at stations between these points. Freight shipped from Port aux Basques to North Sydney amounts to approximately 20,000 tons, which is only about one sixth of the tonnage moving in the opposite direction.

Of the four branch lines only one, the Lewisporte line, carries a significant tonnage of freight. The other three branches scarcely carry sufficient freight to justify their existence. When the branch lines were first built they performed functions in transportation that could not be adequately performed by other carriers. Since the building of roads in these areas an increasing amount of freight has been carried by truck. In the past other branches have been abandoned. Formerly, branches ran southward from St. John's along the coast northward from Whitbourne to Hearts Content, and northward from Carbonear to the end of the peninsula at Bay de Verde. It is likely that the Bonavista and Carbonear branches will be discontinued before the other two. The Argentia branch has a strategic value in serving the naval base, in spite of the small amount of freight traffic it carries, and the Lewisporte branch handles a substantial volume of freight.

Seasonality of Freight Shipments

The total revenue freight tonnage forwarded from Newfoundland stations in 1954 is shown graphically by months in Figure 2. This does not include the freight that enters Newfoundland from outside. The total tonnage is subdivided according to the proportions accounted for by major commodities. The freight movement in January is the lowest of all months, but the volume rises gradually in April and May and then rises greatly in June and July to the peak for the year. In August and September the total volume of freight is somewhat lower, and after September it falls rapidly to the mid-winter low point.

Pulpwood is the major commodity accounting for the tremendous rise in tonnage of freight handled during the summer months. Although some pulpwood is carried in every month of the year, the great bulk of it is moved between June and October. Extensive cutting of pulpwood is carried out during the winter and frequently it is not moved to the railway loading sites until spring break-up when it can be transported by water. The ores and concentrates moved by the C.N.R. originate in Buchans and are eventually shipped from the port of Botwood. During the winter months this port is closed to navigation by ice conditions; as a result, ores and concentrates do not move as freight on the C.N.R. until April, then the traffic is fairly steady until late December. The ores can readily be stockpiled until navigation opens, but in the case of newsprint produced at Grand Falls that ordinarily moves through Botwood shipments must continue throughout the winter. Consequently, the C.N.R. receives substantial quantities of newsprint during the winter months for shipment from Grand Falls to St. John's, an ice-free port. This movement of newsprint begins in January and continues at a relatively high volume until May.

Shipments of sand, gravel and crushed stone do not begin until May and appear in greatest volume during the months from June to December. The bulk of this movement is from Seal Cove to Mount Pearl where it is used by Concrete Products Limited. The quarry is shut down and the movement ceases during the winter months

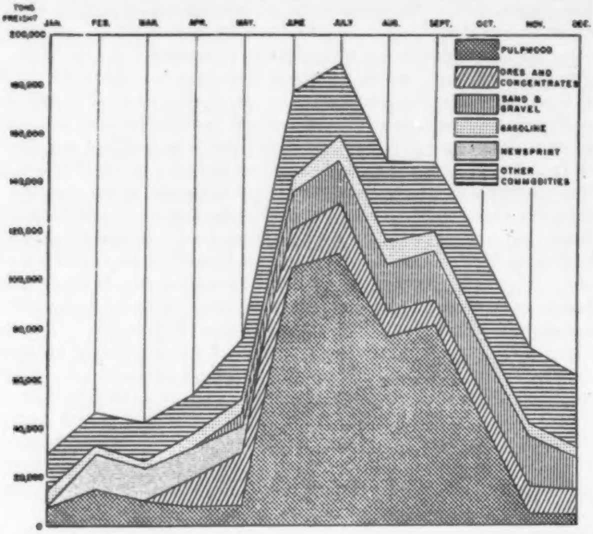


FIGURE 2 - REVENUE FREIGHT FORWARDED FROM NEWFOUNDLAND AND STATIONS IN 1954

because of the slowdown in construction activity at this time. Gasoline shipments are recorded at a similar tonnage for each month, except that July, August and September have slightly higher shipments than the rest. Most of the gasoline tonnage moves from Lewisporte to Gander for use as aircraft fuel. The movement is comparatively regular throughout the year because the consumption is at a continuous rate.

Other commodities are not shipped in sufficient quantities to be shown separately in figure 2 so they are grouped together. A great variety of items is included in this general category. Among the more important commodities are cement, coal, fuel oil, fishery products, and other food products. The freight tonnage of commodities in this group is considerably higher in the months from June to December than from January to May. The lull in general business activity and the slowdown in construction projects during the winter and spring months is largely responsible for these reduced tonnages.

Variations in volume of freight traffic both from month to month and from year to year may be quite pronounced as a result of numerous factors. The length of the navigation season has a great effect on railway freight movements. If the ice forms early in the winter ships may be forced to discontinue operations earlier than usual, consequently, more freight traffic is diverted to the railway. On the other hand, a late closing of navigation affects railway freight movements adversely. Similarly, in the spring an early break-up and clearing of ice permits ships to operate earlier in competition with the railway. The early improvement of weather conditions in the spring, however, has a beneficial effect for all carriers in that construction projects may begin operations earlier. Among the major projects being carried out in Newfoundland are the building of the Trans-Canada Highway which requires many bridges, and the construction involved in modifying and improving the United States

Air Force bases. The lag in construction activity during the winter is reflected in the low volume of cement shipments from the North Star Cement Co. in Corner Brook. Also, the demand for concrete products from the plant at Mount Pearl diminishes in winter. As winter approaches the fuel tanks are refilled and coal piles are replenished, occasioning early fall increases in movements of these commodities, especially to Gander and Grand Falls.

The improvement of weather conditions in the spring of 1954 occurred especially late in the season. This delayed the various construction projects, it delayed the movement of ores and concentrates from Buchans to Botwood. At the same time, newsprint was shipped to St. John's much later than usual instead of being shipped through Botwood. At Gander serious fog conditions in the early summer hampered flying and caused many aircraft to by-pass this refuelling stop. As a result there was a lower consumption of gasoline, and in turn, a lower movement of gasoline by rail from Lewisporte to Gander.

Market fluctuations and competition from other carriers also give rise to variations in freight traffic. The Newfoundland lumber market in 1954 was somewhat uncertain because of competition from the Maritimes. This resulted in a lower rate of cutting in Newfoundland than in previous years, and consequently, a lower volume of lumber was shipped. The volume of "less carload traffic" from St. John's in 1954 had declined from previous levels because wholesalers were importing directly from the mainland in many cases. A large part of this direct freight was being carried by boat to Corner Brook and distributed from there. The movement of pulpwood from Howards, situated a few miles south of Corner Brook, to the paper mill was formerly handled by the railway, but in 1954 this pulpwood was carried by truck.

Conclusion

The operation of the railway in the past has proven uneconomical but necessary as a transportation link between Newfoundland's scattered concentrations of population a and industry. There are many physical disadvantages that make the railway difficult to operate successfully. The steady increase in freight traffic during recent years has improved the position of the railway and this trend will probably continue as population grows. The density of freight traffic varies considerably along the railway both eastbound and westbound as different commodities are handled in serving the industries. The central section between Terra Nova and Humber Canal has the greatest density of freight traffic. Seasonal variations in freight shipments originating in Newfoundland are quite pronounced and depend mainly on weather conditions, but also on market fluctuations and competition from other carriers. Competition with highway transport, which is at a minimum at present, will become much keener when the Trans-Canada Highway is completed. Competition with water transport is already keen because the shipping companies frequently give faster and more satisfactory service between Newfoundland and mainland points. However, during the winter months the railway enjoys a virtual monopoly. Extensive modernization of the railway and its facilities is necessary in order to improve the service provided and meet future competition. Some of the branch lines may be discontinued because they carry very little revenue freight. The railway performs a basic function in the island's economy and will undoubtedly continue in this role.

THE POSSIBILITIES OF SHEEPRAISING IN THE UNGAVA BAY AREA[1]

Marjorie C. Findlay

Steinberg's Ltd.

This paper, based on recent field experience has a three fold purpose. The first is to demonstrate the need among the Ungava Bay Eskimos for small industries, such as sheep-raising, in order to establish the Eskimos as a self-supporting part of the Eskimo and white community in the area. Secondly, it is to consider the physical requirements for raising sheep and the ways in which Quebec can meet them; thirdly, it is to draw attention to some of the Danish experience in training Greenlanders to raise sheep.

The economic situation of the Eskimo

There were, in 1954, 763 Eskimos living round the shores of Ungava Bay. Almost every family was receiving government relief. The only exceptions were the two or three families whose men were employed by the Hudson's Bay Company or the R.C.M.P. In the present day the Ungava Bay Eskimos are not very great hunters. They show some disinclination to go out and hunt even when there are seals in the water and conditions are good. In addition, while there has probably been an increase in population over the last fifty years, one of the main sources of food, the caribou, has all but disappeared during the same period. Before the last war there was starvation among the Ungava Bay Eskimos. Since the war the relief handed out by the R.C.M.P. has kept them alive. Should relief and Family Allowances now be withdrawn it seems unlikely that the group would survive at all.

There is today among the Eskimos a strong tendency to go to Chimo which lies on the southwest side of Ungava Bay, on the banks of the River Koksoak, 30 miles upstream from the Bay itself and where there is a Hudson's Bay Company Post and a detachment of the R.C.M.P. So Chimo is the source of free rations and allowances. The Eskimos like to stay there as long as possible: and the diet of those who live in Chimo consists mainly of the food issued to them, that is bannocks and tea. Their days as self-sufficient hunters are past and at present they are all, to varying extents, paupers.

On the positive side, the Eskimo are very quick to take up work for white people. During the war years, they were employed on the American base at Chimo and since the war they have been employed by the Department of Transport Meteorological Stations, the Provincial Hydrographic Survey, the Quebec Streams Commission, by a merchant exporting scrap iron from the war-time base, and by prospecting companies such as Fenimore Iron Mines Ltd., and Oceanic Iron. They have worked as janitors, truck-drivers, carpenters, interpreters, boatmen, cooks, at loading and unloading vessels, and as general handymen. Their readiness to take as many such opportunities as are offered is undoubted.

However this period of intense activity is confined to a few weeks in summer and to the Eskimos who live on the southwest side of the Bay in the vicinity of Chimo. For the rest, there is hunting and trapping, government relief and Family Allowances. And since they no longer seem to care to hunt, money has come to be of real

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[1] Presented at the January 1957 meeting of the Southern Ontario Division of the Canadian Association of Geographers in Hamilton, Ontario.

significance in their lives.

Total annual family income, with rare exceptions, is less than $1,000 and in the small number of individual cases that were examined Family Allowances and government relief averaged 50% of the family income. A specimen income pattern in 1954 for an Eskimo, his wife and seven children was as follows:

For the 26 white foxes trapped	$ 208.00	
For 3 days labour unloading a ship, in which own peterhead was used	50.00	approx.
Total earnings	$ 258.00	approx.
Family Allowances in food, clothes and ammunition	338.35	
Relief (in seven amounts)	200.33	
Total assistance	$ 538.68	

In this year, this family thus used about $800 of which about $260 was earned.

Now white penetration of the Ungava Bay area is increasing rapidly. Iron ore has been discovered in vast quantities on the west side of the Bay in an extension of the Labrador trough. There is a commercial air line to Chimo which serves prospectors. The development of large scale iron-mining and some preliminary processing on the Eaton concessions is planned for two or three years hence. An air strip has just been constructed on Hopes Advance Bay, on the west side of Ungava Bay, as a preliminary to the construction of a harbour for the export of iron ore to Europe via Greenland. This will be something like a second Knob Lake, with a large white resident population.

Rather than try to persuade the Eskimos to return to their hunting with greater perseverance and live off a decreased supply of game - and hunting is an occupation which ranks low in the scale of economic security, even when the supply is adequate - rather than a return to hunting, it is suggested that we should endeavour to plan for the Eskimos a group of small-scale industries, which should do two things for them. They should give them independence and economic secur'ty, and assist them to adjust to living in the mixed community which is developing in their land, without simply taking the lowest jobs in the white man's pay.

The possibilities of sheep farming

The sheep, among domestic animals, is tolerant of physical conditions, more tolerant than the cow, but less tolerant than the goat. However it is more useful than the goat in the amount of wool and meat it supplies, and it can also be milked if one wishes.

Sheep are farmed in climates ranging from the warm continental of Texas and the hot semi-desert of southwest and southeast Australia to the cold, near continental, of northern Finland and the very cool maritime climates of Iceland and south-west Greenland. Reference to the climatic data in Table 1 shows that if sheep are to be farmed in arctic Quebec, they will be moving into a yet colder climate than they have known before. In fact Chimo's winter temperatures are the coldest listed on that table. Of the places listed in Table 1, Reykjavík is the warmest in January with an average temperature of 31.4°F. It is of course the capital of Iceland, but its climate is typical of the sheep farming country in its neighbourhood. Tromsö comes next, in latitude 69 deg 42' N, with an average of 25.8° in February, its coldest month. It

TABLE 1

Average Monthly Temperature for Certain Northern Stations

Place	Years of Obsvn.	J	F	M	A	M	J	J	A	S	O	N	D	Year	Position Lat.	Long.
		Temperature in degs. F.														
Reykjavik, Iceland	7	31.4	32.0	32.4	34.4	43.0	49.0	51.7	51.9	46.4	39.7	35.6	31.5	40	64°08' N	21°57' W
Tronso, Norway	6	26.4	25.8	27.6	33.8	40.1	48.8	53.3	50.1	45.2	40.5	33.1	29.6	38	69°42' N	19°01' E
Narssarssuaq, Gnld.	12	20.9	18.3	27.5	31.5	42.5	49.7	51.6	49.6	42.9	33.8	28.8	23.5	35	61°10' N	45°28' W
Kajaani, Finland	5	15.0	12.1	21.6	35.5	43.9	56.5	58.6	57.4	46.3	36.7	26.7	23.9	36	64°13' N	27°43' E
Prince George, B.C.	27	12.9	18.4	29.8	40.4	49.2	56.2	59.6	58.8	50.2	41.4	29.4	16.5	38.5	53°50' N	122°47' W
Beaverlodge, Alberta	31	5.6	13.0	21.8	37.6	48.7	55.5	59.8	57.6	49.0	38.8	24.4	11.8	35.3	55°N	120' W
Nome, Alaska	7	2.7	-1.5	7.8	17.3	36.0	45.3	50.1	49.0	42.4	30.9	18.6	4.7	25	64°31' N	165°26' W
Chimo, P.Q.	10	-12.9	-11.8	3.2	16.2	32.4	44.8	52.6	50.5	41.8	31.4	17.1	0.2	22	58°05' N	68°25' W

TABLE 11

Average Monthly Precipitation for Certain Northern Stations

Place	Years of Obsvn.	J	F	M	A	M	J	J	A	S	O	N	D	Year	Position Lat.	Long.
		Precipitation in inches														
Reykjavik, Iceland	7	4.0	3.6	1.8	1.8	1.6	1.2	2.2	1.9	2.1	3.6	3.2	2.6	29.6	64°08' N	21°57' W
Tromso, Norway	6	5.5	2.4	4.6	3.0	2.3	2.1	1.8	1.7	4.3	4.6	5.0	4.8	42.1	69°42' N	19°01' E
Narssarssuaq, Gnld.	12	1.8	2.5	1.7	1.5	1.6	1.5	3.9	2.8	4.5	3.4	2.4	2.0	30.6	61°10' N	45°28' W
Kajaani, Finland	5	1.1	0.6	1.0	1.3	1.2	3.2	3.9	2.7	2.3	1.5	1.7	2.0	22.5	64°13' N	27°43' E
Prince George, B.C.	27	1.81	1.21	1.44	0.84	1.34	2.06	1.63	1.94	2.00	1.99	1.87	1.85	19.98	53°50' N	122°47' W
Beaverlodge, Alberta	31	1.27	0.90	1.17	0.78	1.64	2.11	2.21	1.81	1.71	1.11	1.28	1.20	17.19	55°N	120°W
Nome, Alaska	7	1.0	0.6	0.7	0.7	0.6	1.4	2.6	5.4	2.7	1.2	1.0	1.2	19.1	64°31' N	165°26' W
Chimo, P.Q.	10	0.8	0.6	0.8	0.8	1.2	1.3	2.3	2.5	2.0	1.5	1.5	1.1	16.4	58°05' N	68°25' W

has a marked positive temperature anomaly on account of the influence of the Atlantic Drift. It stands on a skerry coast noted for fishing and subsistence farming, which includes a few sheep. Narssarssuaq, with 18.3°F. in February, is a little colder. It is the site of an American air base on the southwest coast of Greenland and lies in the centre of the present day sheep farming area. Kajaani, in latitude 64 deg. N. with an average February temperature of 12.1°F., is a company town based on a pulp mill in Finland. The surrounding country people live by subsistence farming and winter work for the Company in the forests. The farms here generally have a few sheep - that is to say less than 10. The next two stations are in Canada; Prince George in British Columbia and Beaverlodge in Alberta. They have both been the sites of sheep-raising experiments carried out by the Animal Husbandry Division of the Department of Agriculture. At both places it is perfectly feasible to raise sheep as far as the climate is concerned, and there is no basic problem in connection with either summer or winter feed. Nome, Alaska, in 64 deg N, with -1.5°F. average February temperature lies in the area in which a reindeer herding experiment is being carried out.

Lastly Chimo, in 58 deg.N, and with a January temperature of -12.9°F., while among the most southerly of the stations, has the lowest winter temperature. The negative temperature anomaly is here among the greatest in the world.

In the face of Chimo's severe winter climate two points can be made; first that the bounds of human activities are continually being moved northwards, and secondly that plain cold, that is low temperature, is in no way detrimental to the well-being of sheep.

The northernmost limits of our industries are continually moving poleward. The iron-mining which is of increasing significance to Quebec is a very suitable example. At Gellivare, in Northern Sweden the open cast mines have been regarded as a far northern exploit, but the open cast mining at Knob Lake in central Quebec is carried out under much more severe conditions. And now it is planned, as I have already mentioned, to begin open cast mining of iron ore on the west side of Ungava Bay in temperatures a little colder than those at Chimo.

Likewise sheep-farming itself has been recorded as moving into successively colder climates since the end of the ninth century. During the ninth century Iceland was settled from Norway and the northernmost British Isles. In the north and north-western parts of Iceland the sheep were brought to a harsher climate. From the north-west of Iceland, Erik the Red discovered and settled Greenland in 982 and succeeding years, taking with him boatloads of women, children, cattle, grain and sheep. The Norsemen and their sheep-farms survived for at least 500 years in Greenland in the same area, around Narssarssuaq, as the present day farmers live, and are estimated to have had 30,000 head of animals at their peak.

At the beginning of this century sheep farming again moved north. Sheep were taken from Scotland to Greenland and from the Faroes to Greenland in two preliminary experiments before 170 were finally taken from Iceland to Greenland in 1914. These sheep thrived, so that in spite of slaughter for food there are now about 20,000 of them. Sheep-farming, like iron-mining, and like farming in Alaska and industry in Siberia, is moving north.

Secondly in the face of the low winter temperatures prevailing round Ungava Bay it can be said that cold in itself is not harmful to sheep. They can be out of doors with snow on the ground and thrive. At a Demonstration Farm in New Liskeard, Ontario, sheep are out of doors in winter in temperatures of -35 deg. F. What is dangerous for sheep is the range of temperatures immediately above and below freezing point. With alternate freezing and thawing, ice forms in the sheep's wool, chilling them, and if an icy crust forms on the surface of the snow, the sheep are most likely to break their legs and die out on the hillsides. But once the temperature gets well below freezing point and the winter is established, the sheep are reasonably

safe. Cold winters are not a thing the farmer has to fear.

Under conditions below freezing point, sheep should be kept close to the farm and if there is any danger of storms, there should be an enclosure for them to prevent their getting lost. It is usual to provide a windbreak such as a fence, a line of trees or a haystack, but it is not very customary to keep them in stalls day and night. Opinion differs as to the advisability of housing, the benefits of protection from weather being counteracted by the bad effects of lack of light, space and fresh air. Probably the middle way is best, that is having stalls for shelter at night in the very coldest weather, and turning the animals out every day.

The provision of food for sheep falls into the two categories of summer grazing and winter fodder. Again the sheep can thrive on a variety of plants in a wide variety of environments, moorlands, meadows, marshes, plains and semi-desert. Once more it is easier to feed than the cow, though the goat is even less demanding. In addition to grasses, sheep will eat the green parts of birch, willows and crowberry plants, reindeer moss, heather, seaweed and even fish, such as caplin and cod. The plants listed in this group are those which form the typical lichen heath found all round the coastlands of Ungava Bay. On the vegetation map (Figure 1), it can be seen that the tree-line crosses the southern coast of Ungava Bay. North of this line the lichen heath is ubiquitous with the reindeer moss predominating and a limited growth of the other elements, especially in sheltered places. South of the tree-line the lichen heath is interrupted by stands of spruce and larch, especially along the water-courses. The hatching on the map indicates areas of scrub, - that is areas where willows, birch and berry plants form a significant part of the cover. These would provide the best summer browse for sheep. Such areas can be found along the Leaf, Koksoak, Kaniapiskau and False Rivers. In view of these facts, there appears to be adequate summer grazing for a small scale sheep industry on the south and west coasts of Ungava Bay. This was confirmed by two members of the Department of Agriculture, Messrs. Lajoie and Nowasad who came up to Chimo in the summer of 1954 to consider the potentialities of the area for sheep. They reported very favourably on the availability of summer browse in the area they visited, which was the valley of the Koksoak and lower False Rivers.

Winter fodder is required as long as there is a complete snow cover or the animals are completely indoors. All the plants already mentioned can be used as winter feed, that is willow and birch leaves, heather and reindeer moss. All of these have been used in Greenland. Branches of willow and birch leaves can be gathered and stored, though this practice is not much seen nowadays. The use of reindeer moss is also reported in Finland by Hustich, who says that moss was mixed in the proportion of one part moss to two parts hay as winter feed for sheep, cattle and goats in northern Finland. The caplin which has recently been reported in the waters of Ungava Bay, is caught in quantity close to the Greenland shore and dried for winter fodder for sheep. However all these foods can only be regarded as additional aids to eke out the sheep's supply of its chief fodder, which is hay. For this, there is no substitute and if sheep are to be kept round Ungava Bay, hay must be found for them.

The amount of hay required varies with the length of the winter and the size of the sheep. The length of the winter is often itself variable and this can be hazardous for the farmer who has neglected to supply fodder for the longest winter possible. The Greenland Department has stated that to the best of their knowledge the fodder requirement for each sheep in an Icelandic winter ranges from about 100 to 150 kg. Of their own sheep, the Greenland Department says that the fodder consumption in winter per sheep is about 40 kg. of hay per sheep, to which must be added about 70 kg. of silage per sheep, as well as caplin and concentrated feeding stuffs. In the most carefully treated native flocks in Greenland, where the flocks have access to grazing for part to the time, the consumption of hay is about 10 to 20 kg. per sheep. My own experience is that many of the sheep in Greenland survive on even less. The wide variation of

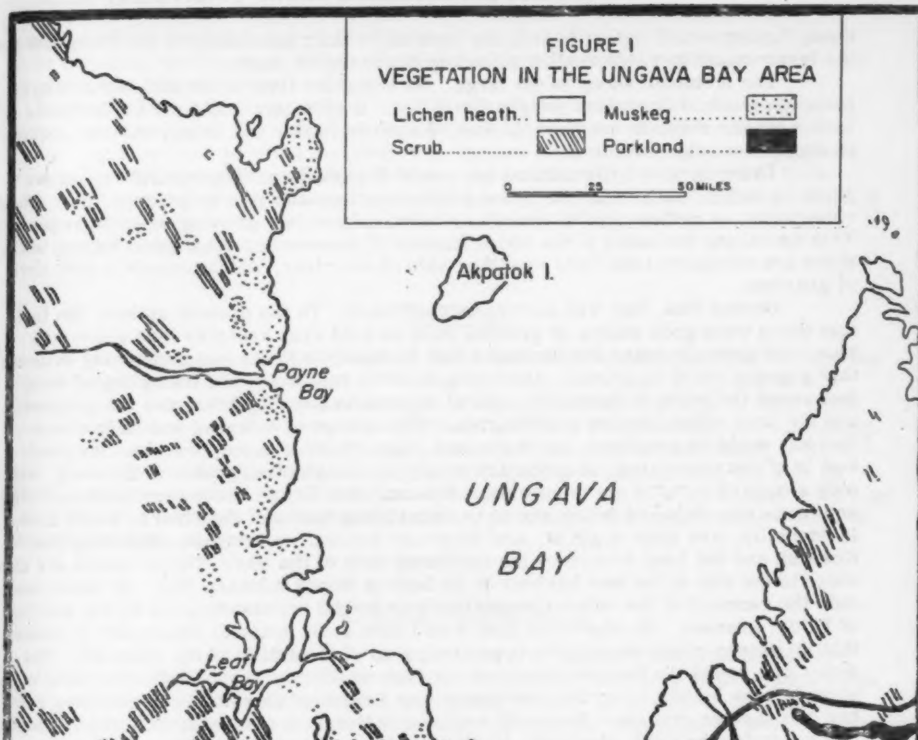
FIGURE I
VEGETATION IN THE UNGAVA BAY AREA
Lichen heath..
Muskeg.........
Scrub..............
Parkland ....
0
25
50 MILES
Akpatok I.
Payne Bay
UNGAVA BAY
Leaf Bay
TREE - LINE

these figures would appear to indicate once more the adaptability of the sheep and also the large extent to which auxiliary feeding stuffs can be used.

The Icelandic sheep is not large. At slaughter time in the fall, an average Icelandic lamb in Greenland weighs 79-85 lbs. It certainly would not be advisable to have a larger sheep in northern Quebec, for more fodder will in any case be required to supply the longer winter.

There is very little natural hay round Ungava Bay. The natural vegetative cover is lichen heath, with the lichen predominating, and coarse grasses, as a minor component. A rather careful search revealed natural hay growing in only one place. This was along the banks of the False River. The river is tidal a great way up and there are extensive tidal flats on either side of the river, which support a rich cover of grasses.

Beyond this, hay will have to be cultivated. To the present author, the fact that there were good stands of grasses such as wild rye, kentucky blue grass and blue joint growing round the Hudson's Bay Company's Posts was convincing evidence that grasses could be grown. According to white residents, the trampling of many feet round the posts destroys the natural vegetation more or less, and the grasses are the ones which survive and flourish. The opinion of Nowasad and Lajoie was that hay could be produced, but that some expenditure of money would be involved. Soil is of course scarce, in a country where the lichen often grows on the rock, with only a tangled mass of roots between. Nowasad and Lajoie recommended the alluvial and lacustrine deposits which are to be found along banks of the rivers, which also, incidentally, are easy to get at, and there are several such rivers, including the Koksoak and the Leaf Rivers on the southwest side of the Bay. These rivers are also close to the site of the new harbour to be built at Hopes Advance Bay. In some cases only the removal of the natural vegetation was judged necessary prior to the seeding of fodder grasses. In others the land would have to be drained, especially to ensure that no excess moisture retards the warming up of the soil in early summer. The sandy soil round the former American air base at Chimo, from which the rocks have already been bulldozed by the Americans was suggested as suitable for seeding with hay and pasture grasses. Nowasad reported of this area that several scores of acres are ready for the drill, that light discing and harrowing are probably all that is required, and that although the soil is poor, commercial fertilisers or green cover crops should enable food forage plants to be established to produce hay and pasture.

The length of the growing season in 1954 was about 99 days, from June 8th to September 15th, (the growing season being defined as the number of days with mean daily temperature above 42°F.) which is enough to grow a hay crop. However the length of the growing season is very variable, and the average number of frost free days is less than 50. However not every frost is a killing frost.

According to Dr. F. W. Banfield, predators of the wild variety, such as wolves, are not likely to be a serious menace to sheep. It is to be suspected that the number of wolves in northernmost Quebec has decreased considerably in association with the near disappearances of their prey, the caribou.

There is however, one domestic animal which will certainly give trouble if it gets a chance, and that is the husky. These dogs are owned in teams for pulling sledges by most Eskimo families. They are strictly working dogs and never become pets once they are past the puppy stage. They receive the minimum of care and the minimum of food and the result is that they are ferocious and always ravenously hungry. They will attack a single human being, especially if they sense that he is nervous. Undoubtedly the sheep, which is among the most foolish of animals, will be fair game for them if given a chance. And this is perhaps the most immediate problem that faces any sheep-farming experiment. For the present there is only one solution, and that is to keep the sheep and dogs apart. During the first few years sheep must be

kept away from the trading posts and Eskimo camping places. Fortunately this is quite possible, and some of the places which seem most suited to sheep are not used at present by human beings.

A further possibility, where a summer camping site may clash with a sheep farm, would be to put the Eskimos' dogs on one of the many islands in the vicinity. In the long view it is possible that dogs will become superfluous in Eskimo economy. That will certainly not happen while they are dependent on a pittance earned from trapping foxes, but if new industries are introduced, and also if a reliable mechanical sledge can be perfected, one may foresee the eventual disappearance of the husky. This has already happened in south Greenland.

The Future

There remains a consideration of the future sheep farmers themselves and the adjustment they would have to make in taking up sheep-farming. The position of a farmer in the new mining community which is expected to develop will be very much better than that of a hunter-trapper. A farmer will have independence and bargaining power. He will have meat and wool (and probably vegetables) for his family. He will have the same commodities to sell to white mining companies and from the sale he will have an income, which will help him to house, clothe and feed his family. We may admit that this will be to some of the Eskimos' advantage, but can we expect some of them to make the change?

The Greenland experience

The only useful method is to look at the one comparable situation where experience is available. In the modern period, sheep have been kept in Greenland since 1904, and the number of native Greenlandic sheep-owners is now 250. Of these 250, about 25 are real full-scale farmers with flocks of over 200 sheep, well-built two-storey homes, a vegetable plot, and a few cows and hens. The rest are very like the crofters of the Scottish Hebrides, that is they have a few sheep, usually less than 25, sometimes a vegetable plot, and combine these with cod-fishing from rowing and motor boats - the fishing being the chief occupation. All of them benefit from having meat ready on the hoof when they need it, and there is also among the Greenlanders a marked pride in the title "sheep-keeper", which is akin in worth to the former English title "Farmer" - and which far outweighs the equivalent "Fisherman" - which is the title used by those fishermen who have no sheep.

The big farmers on their homesteads have achieved a completely new way of life which is real farm life, as opposed to the hunter's. They are settled up the fjords away from the coast and they think in terms of weather for haymaking and fall prices for young lambs.

We should however bear in mind that the Greenlanders are much more a mixture of Eskimo and European stock than the Ungava Bay Eskimos are at present and it is a matter of observation that the most successful Greenlandic sheep farmers are frequently descended from an upper class of Greenlanders which has been founded by pastors and outpost managers.

The Greenlanders have quickly learned that domestic animals must not be killed, and instances of such killings are extremely rare. On the other hand most of them are rather slow to realise that sheep, unlike wild animals, must really be looked after. For instance about 75% of the Greenlandic sheep are left out on the hills right through the winter, for the most part, without hay and without shepherding. An unrecorded number die, and the successful example of the careful farmers, whose flocks

increase, is only slowly decreasing the general lack of winter care. The majority of Greenlandic farmers do not make enough hay for their sheep (and cows). I have already quoted the figures, and it can be noted that the Director of the Sheep Station - which leads and advises on all farm practice in Greenland - recommended the use of a much higher quantity of hay than was found on even the best native farms. This lack of foresight is typical of Eskimo character and goes with a hunting way of life. We should certainly expect it at Ungava Bay.

Nevertheless the achievement is significant. Lamb has been produced beyond the farmers' needs, has been sold up and down the Greenland coast and has even been exported to Denmark, whilst the successful farmers are the new native aristocracy, succeeding the older predominant hunters.

Appendix

It is very satisfactory to record that an experiment in sheep farming has now actually begun. Mr. Ben Sivertz, of the Northern Administration and Lands Branch of the Department of Northern Affairs reports as follows:-

"In July 1955, ten sheep consisting of five Suffolk ewes and five cross-bred lambs were sent to Fort Chimo on the Hudson's Bay M.V. Rupertsland. The Department of Agriculture supplied the sheep and this administration assumed the responsibility for feeding and caring for the animals.

The sheep were taken to False River where they remained until the fore part of October when they returned to the settlement. During the summer hay was made from the False River flats. Three lambs were slaughtered early in the fall. The average live weight was ninety-two pounds and the dressed weight was forty-five pounds which is somewhat better than the average growth rate for southern Canada. The three ewes which were kept over the winter each produced twin lambs this spring."

The lambs slaughtered were thus a little heavier than the average in Greenland, but as there were only three of them, the average has little value. The experiment continues and the Department now has a plan to set up a small experimental farm on the same False River.

There is a discrepancy between the five Suffolk ewes which were taken up to Chimo and the three which over-wintered and produced sets of twins. And thereby hangs a tale - perhaps one that can be anticipated. One Sunday during the winter months, while Jacob their Eskimo shepherd, was at church, two husky dogs got into the enclosure and killed two of the sheep. You may say it was inevitable, but the unfortunate fact is that it was no Eskimo-owned husky dog than ran amok - the dogs belonged to the Chimo detachment of the Royal Canadian Mounted Police.

WIND CHILL IN NORTHERN CANADA[1]

M.K. Thomas and D.W. Boyd

Meteorological Branch, Dept. of Transport

Man has talked about the weather since the beginning of time. Frequently these discussions and arguments have concerned relative coldness, that is "whether last Tuesday" or, "that cold day last winter", was colder than this morning. During these thousands of years, man has invented various methods of protecting himself from the weather. He has learned to wear clothing, to find or build himself a dwelling, and more recently, to heat his dwelling in cold weather, to ventilate or cool it in hot weather, and even to control the humidity.

Man has also devised methods of measuring the weather elements. Over three hundred years ago he invented the thermometer and used it to measure the temperature of the air. He found that it gave higher readings in the sun than in the shade. Now he has discovered why the readings are different and has learned to measure solar radiation, and other elements that affect his comfort, such as humidity and wind speed. However, the arguments still continue: "Is it colder in Halifax when the northwest wind pushes the temperature down to zero, or in Saskatoon on a calm, sunny day with the temperature thirty below?"

It must be admitted that coldness, for most of us, is not a simple matter of low temperature. Currie[2] attempted to measure this coldness by using the only available instrument which would give the correct answer: the human body. Only the human body can measure how cold the weather feels. The students who helped Professor Currie at the University of Saskatchewan aggreed quite well about how cold it was each winter morning on their way to lectures. Their coldness sensations were plotted on a diagram using temperature and wind speed as coordinates, and isopleths of sensation were drawn and labeled with such terms as cool, cold, and bitterly cold. Currie's diagram shows how coldness depends on wind speed, but it does not take into account other factors such as humidity and solar radiation.

The coldness of the body also depends on the amount of activity of the person and the amount of his clothing. This may influence his estimate of the coldness of the weather. Currie kept these factors fairly constant by using only the reported sensations of students who were walking or waiting for transportation and who were similarly clothed. However, the sensations of a group of students at Dalhousie University in Nova Scotia would probably produce a quite different diagram due to differences in clothing habits and in the weather thet are accustomed to.

It is obviously necessary to have some device which is much simpler than using students as an instrument to measure coldness. The rates of loss of heat from other objects must be measured and these rates assumed to indicate the rates of loss of heat from exposed flesh. This in turn will indicate whether clothing is required to keep a human being comfortable.

The same thing could be expressed somewhat differently. What is required is

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[1] Presented at the January 1957 meeting of the Southern Ontario Division of the Canadian Association of Geographers in Hamilton, Ontario and Published with the permission of the Director, Meteorological Branch, Dept. of Transport.

[2] Currie, B.W.: "Sensation isopleths on a wind-temperature diagram for winter weather on the Canadian Prairies"; Bull. Amer. Met. Soc., 32, 1951, pp. 371-374.

a measurement or estimate of some elusive characteristic of the weather which is frequently referred to as "coldness" and which is known to depend on temperature, wind speed and other weather elements. This coldness is probably closely related to the rate of loss of heat from exposed flesh and is frequently assumed to be proportional to the measured rate of cooling of a suitable object.

Cooling rates have been measured for many objects including thermometer bulbs of various shapes and sizes, platinum wires, and copper cylinders and spheres. From these experiments and also from theoretical considerations it is found that the rate of loss of heat (h) whether by radiation, convection or conduction is very nearly proportional to the difference in temperature (Δt) between the object and the surroundings. $h \propto \Delta t$. This assumes that the surroundings are all near air temperature and hence does not take account of solar radiation.

The rate of heat loss by convection depends on the wind speed (v). With streamline flow it is a linear function of the square root of the wind speed according to most authorities. $h \propto \sqrt{v} + \text{const}$.

For turbulent flow Reynolds[1] in 1874 found the rate of heat loss to be a linear function of the wind speed. $h \propto v + \text{const}$. The general form including both cases would be: $h = \Delta t(A + B\sqrt{v} + Cv)$

By choosing a suitable value for the constant "A", this form could include radiation and conduction. The values of the constants "A", "B" and "C" differ considerably in the formulae proposed by different investigators, and quoted by Court[2]. This is to be expected because "h" also depends on certain properties of the cooling body. Some investigators have used powers of "v" somewhere between one half and one. It is obvious that the different results and this increases the difficulty of the air lead to quite different results and this increases the difficulty of selecting a suitable formula. Much of the work on cooling power has been done at quite low wind speeds and most of it at temperatures above freezing. Since the latter part of this paper is concerned with conditions in the Arctic it seems reasonable that we should use a formula which is based on observations obtained at low temperatures and with moderate winds.

Siple,[3] has had considerable experience in Antarctica and during the winter of 1941 he measured the time required for the freezing of 250 grams of water in a plastic cylinder about 2 1/4 inches in diameter and 6 inches long, under a variety of conditions of low temperature. He assumed that the rate of heat removal was proportional to the difference in temperature between the cylinder and the air and that the cylinder remained at the freezing point throughout the period of freezing. The results were expressed in kilogram calories per square metre per hour per degree Centigrade and plotted against wind speed in metres per second.

Siple disregarded a few of his experimental results for one reason or another, and on the basis of the remaining readings he computed the formula: $h = \Delta t(10.45\ 10\sqrt{v} - v)$.

Court[2] recalculated Siple's formula using, in addition, the data which Siple had rejected. This gave: $h = \Delta t\ (9.0 + 10.9\sqrt{v} - v)$. This latter form has been adopted by the Quartermaster Corps of the U.S. Army and has been used by Bristow[4]

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[1] Reynolds, O.: "Rate of heat loss in turbulent flow"; Proc. Lit. Phil. Soc. Manchester, 14, 1874, p. 9.

[2] Court, A.: "Wind Chill"; Bull. Amer. Met. Soc., 29, 1948, pp. 487-493.

[3] Siple, P.A.: "Measurements of dry atmospheric cooling in sub-freezing temperatures; Proc. Amer. Phil. Soc., 89, 1945, pp. 177-199.

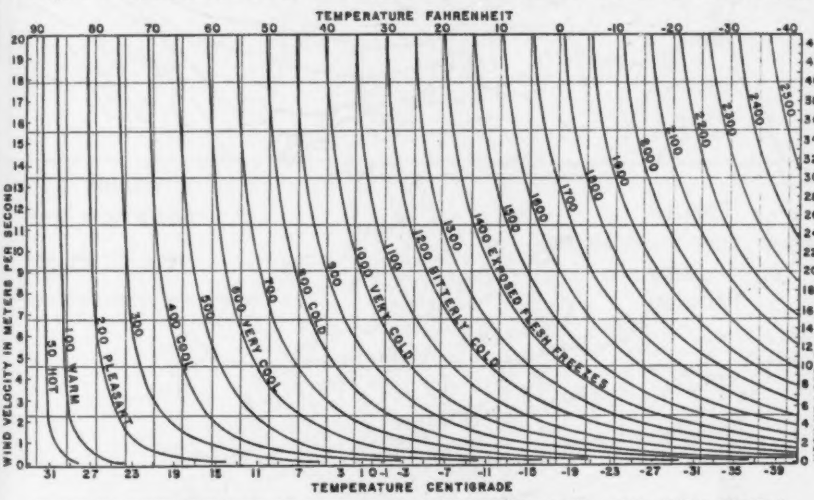
[4] Bristow, G.C.: How cold is it? Weekly Weather and Crop Bull.; 42, 1955, pp. 6-8.

in preparing wind chill maps of the United States.

Siple's original formula has been chosen for the present paper and hence the maps are not strictly comparable to those published in the United States. The cooling times in his experiments varied from less than an hour to about 24 hours and hence either hourly or daily mean values of wind speeds and temperatures should be used. If mean values of wind and temperature for longer periods are used the resulting wind chill will be considerably greater than the mean of the individual wind chill values. The error will depend largely on the variability of the wind speed, since the wind chill is not a linear function of the speed. Siple himself, however, used monthly mean values to compute wind chills. Since the error always has the same sign, the values will at least be comparable and that is all that is needed. One must, of course, be careful not to compare daily values with values computed from monthly means.

Figure 1 is a nomogram based on Siple's equation with wind speed and temperature as coordinates. Halifax with conditions such as mentioned above, a temperature of 0°F and a wind of 20 miles per hour would give a wind chill of 1600 units. Saskatoon at -30°F. would need a 6 mile per hour wind to give the same wind chill value. With a lighter wind or in the sun it would not be so cold.

Figure I-NOMOGRAM OF DRY-SHADE ATMOSPHERIC COOLINC (After Siple)



COOLING IS EXPRESSED IN KILOGRAM CALORIES PER SQUARE METER PER HOUR FOR VARIOUS TEMPERATURES AND WIND VELOCITIES. THE COOLING RATE IS BASED UPON A BODY AT A NEUTRAL SKIN TEMPERATURE OF 33 C. (91.4 F.). WHEN DRY COOLING RATE IS LESS THAN THE RATE OF BODY HEAT PRODUCTION, EXCESS HEAT IS REMOVED BY VAPORIZATION. UNDER CONDITIONS OF BRIGHT SUNSHINE COOLING IS REDUCED BY ABOUT 200 CALORIES. EXPRESSIONS OF RELATIVE COMFORT ARE BASED UPON AN INDIVIDUAL IN A STATE OF INACTIVITY.

Montly values of the wind chill factor have been obtained directly from monthly mean values of temperature and wind speed. Figure 3 is the mean temperature map for January based on data to the end of 1950. The length of record varies from 30 years at a few Mackenzie valley stations to 5 years at Alert on Ellesmere Island, the most northerly station in Canada. (The locations of stations are shown in Figure 3). Further south, in settled Canada, the data are based on the standard 30-year period

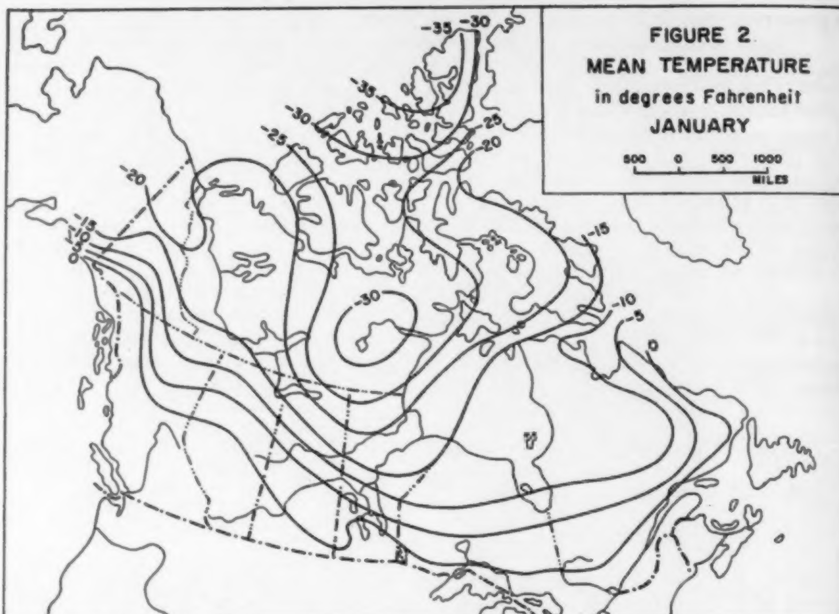


FIGURE 2
MEAN TEMPERATURE
in degrees Fahrenheit
JANUARY

FIGURE 3
LOCATION MAP

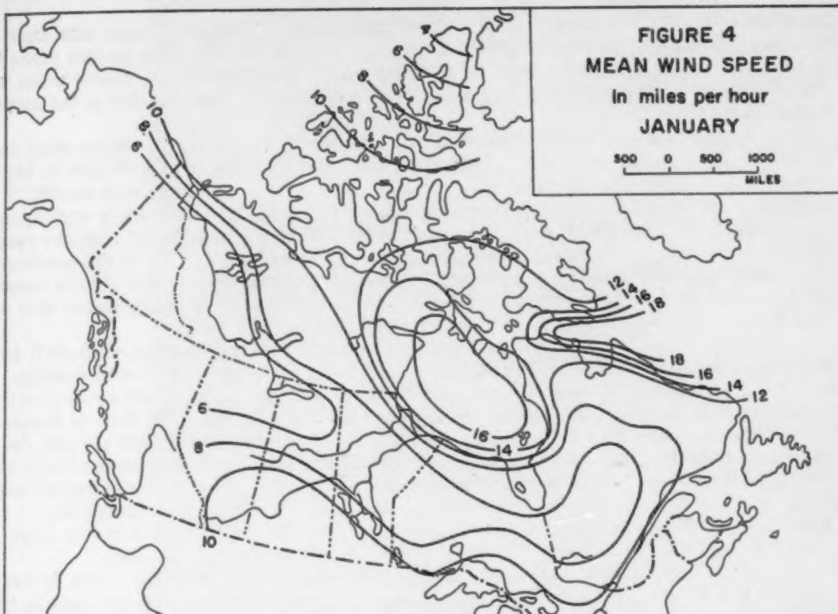


FIGURE 4
MEAN WIND SPEED
In miles per hour
JANUARY

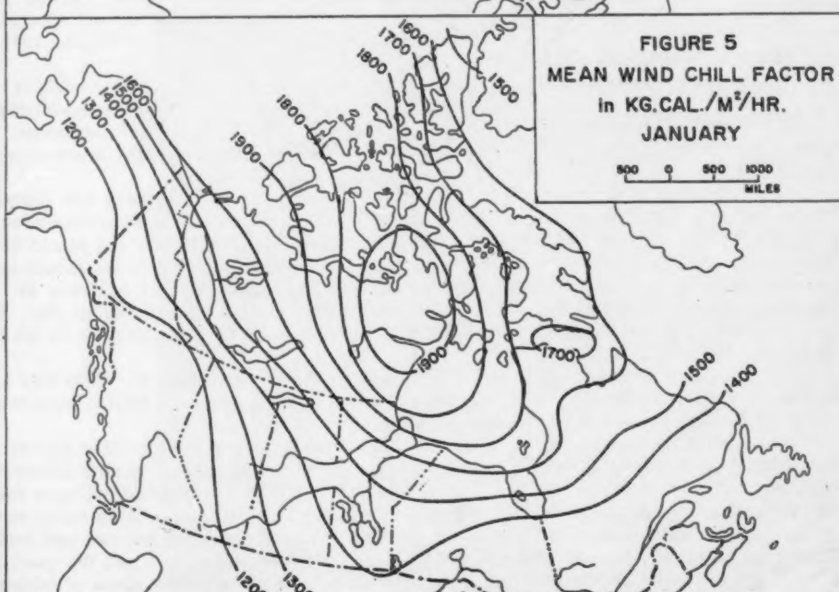


FIGURE 5
MEAN WIND CHILL FACTOR
in KG.CAL./M²/HR.
JANUARY

from 1921 to 1950. Available data indicate that there is an area in Keewatin District that is colder in mid-winter than the Arctic coast to the north. It is in fact more than 10 degrees colder than the coastal area north of Aklavik. However, lower mean temperatures, more than -35°F., are experienced at Isachsen and Eureka in the northernmost Arctic.

A map of mean wind speed in January is shown as Figure 4. Mean wind speed maps are not entirely satisfactory since the immediate location of a station is of prime importance and because periods of calm do much to lower the mean will speed. The data used are based on irregular periods ending in 1954. The relatively high speeds over Hudson Bay and Strait are at once apparent and contrast sharply with the relatively low speeds in the Yukon and mid-continental areas as well as in the northernmost Arctic. The core of the high mean speed area extends along the Arctic coast of the mainland. Recent reports from new stations in this area suggest that this core may be even more pronounced than shown here.

Using these temperature and wind data, monthly values of the wind chill factor were computed, using the Siple nomogram, for all Arctic and sub-arctic weather reporting stations. While the factor was the greatest in February for several stations, 75 per cent of the stations showed the greatest montly value of wind chill in January.

The January map (Figure 5) shows that the factor exceeds 1900 Kg-cal./sq.m./hr. in most of the District of Keewatin. Baker Lake with 1980 and Chesterfield with 1950 Kg-cal./sq.m./hr. have the distinction of being the worst meteorological stations in Canada on the basis of wind chill. Isachsen with 1840, and Mould Bay, Resolute and Cambridge Bay with 1800 are almost as severe as are Ennadai Lake with 1820 and Churchill with 1740 despite their more southerly latitudes.

It is interesting to note that some populous southern Canadian cities do have high wind chill values in January. Winnipeg with 1490 is higher than any station in the relatively calm Yukon Territory and even Montreal with 1220 is almost as cold as Whitehorse with 1250. At Toronto in January the value is 1110, at Halifax 1000 and Victoria 820 Kg-cal/sq.m./hr.

Figure 6 illustrates the mean wind chill factor in the mid-spring month of April. Because of the seasonal temperature lag, the wind chill values are still high in April and the pattern is similar to that of January. The "core" of the extreme values has moved north to the islands but April is still a winter month, more severe in this area than Winnipeg in January.

During the mid-summer season wind chill values in the far north are comparable to January values at Victoria, B.C. In July, (Figure 7), the most severe area is along the northwest coast of the Arctic islands where Isachsen is 840 and Mould Bay 830 Kg-cal./sq.m./hr. Values in excess of 800 are also observed in the mouth of Hudson Strait at Resolution Island, where the July mean temperature is below 40 degrees. In comparison, the value at Toronto in July is 330 Kg-cal./sq.m./hr. Since solar radiation is not taken into account this map applies only to conditions in the shade and its value is doubtful.

The October mean wind chill factor map is shown as Figure 8. This map has a pattern similar to the July map, although values in the northwest Arctic islands are equal to January values in southern Manitoba.

It might be interesting to compare these wind chill maps with other measures of coldness or severity of winter conditions in Northern Canada. Figure 9 illustrates the distribution in Canada of mean annual total degree days below 65°F. These degree day values are used in estimating fuel consumption. Since this map illustrates an accumulation over the season the increase from south to north is quite marked and perhaps illustrates a more common idea of the difference between the Arctic and the south.

Many people are interested in extremes and often base their ideas of coldness on the lowest temperature ever recorded in any location. In Canada the lowest temperature ever officially reported is -81°F at Snag in February 1947. As indicated in

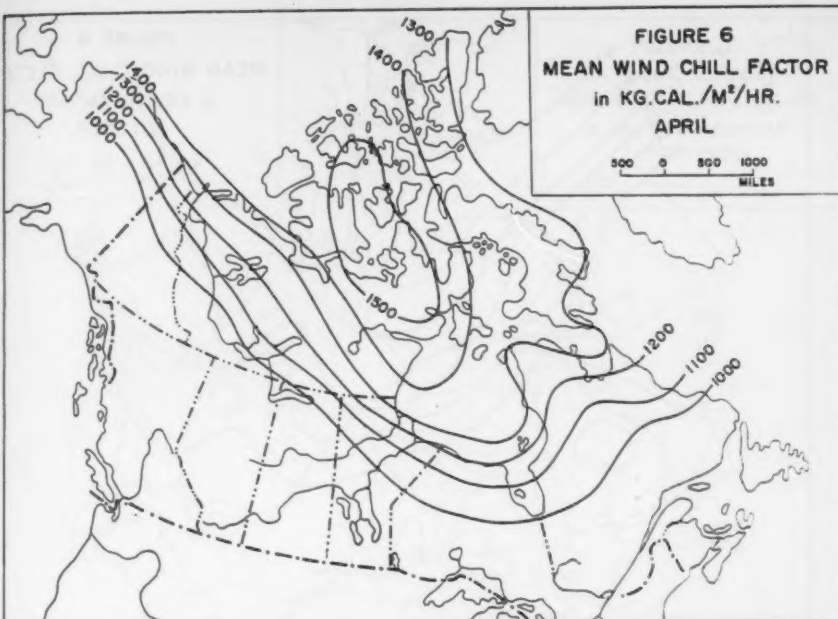


FIGURE 6
MEAN WIND CHILL FACTOR
in KG.CAL./M²/HR.
APRIL

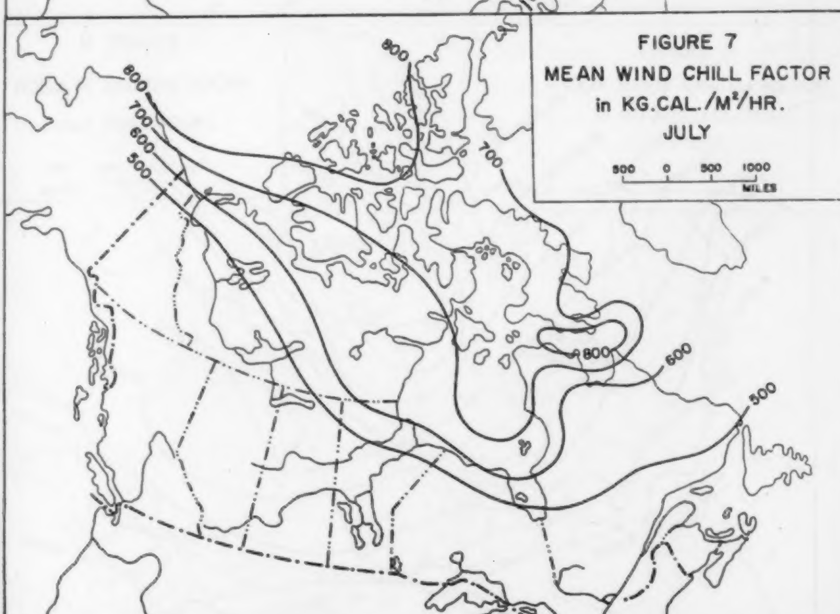


FIGURE 7
MEAN WIND CHILL FACTOR
in KG.CAL./M²/HR.
JULY

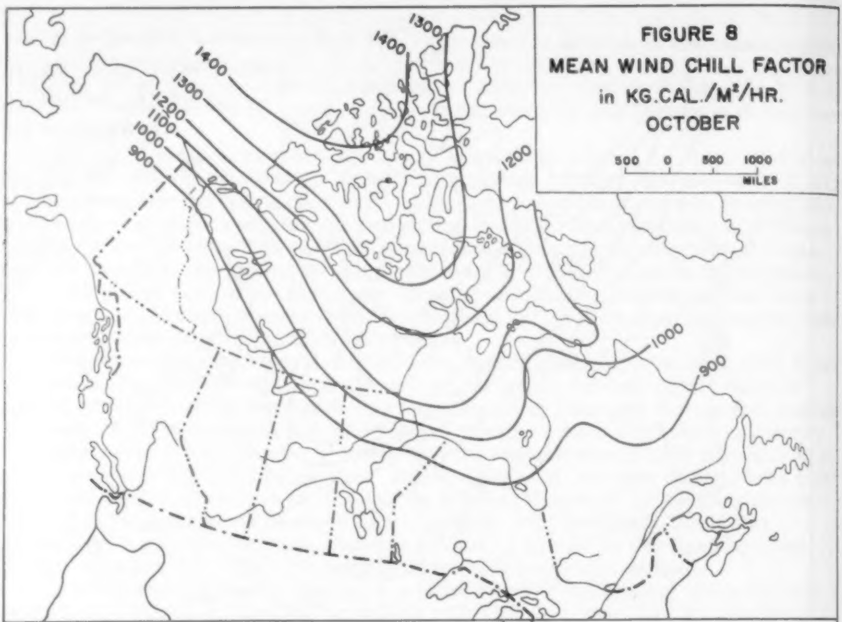


FIGURE 8
MEAN WIND CHILL FACTOR
in KG.CAL./M²/HR.
OCTOBER
500 0 500 1000
MILES
1400
1300
1200
1100
1000
900

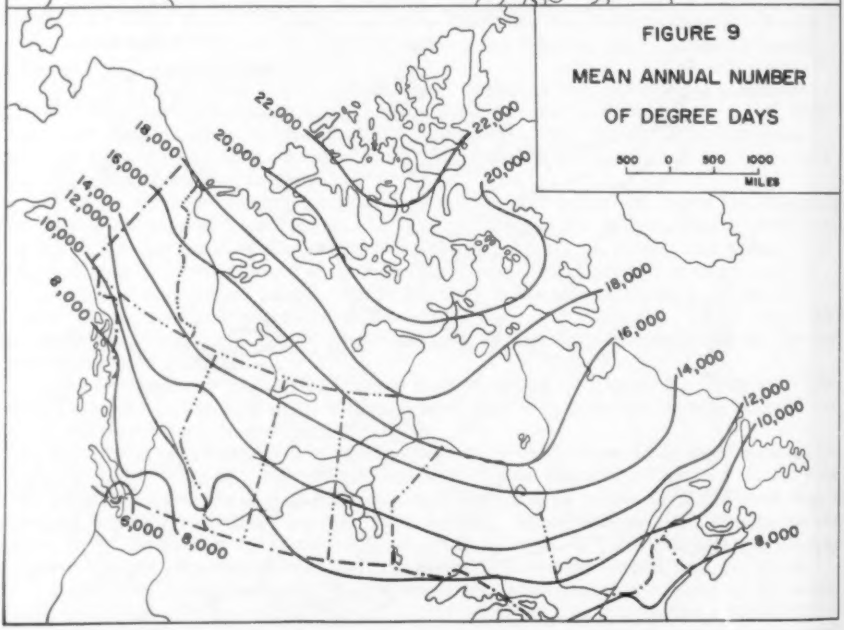


FIGURE 9
MEAN ANNUAL NUMBER
OF DEGREE DAYS
500 0 500 1000
MILES
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000

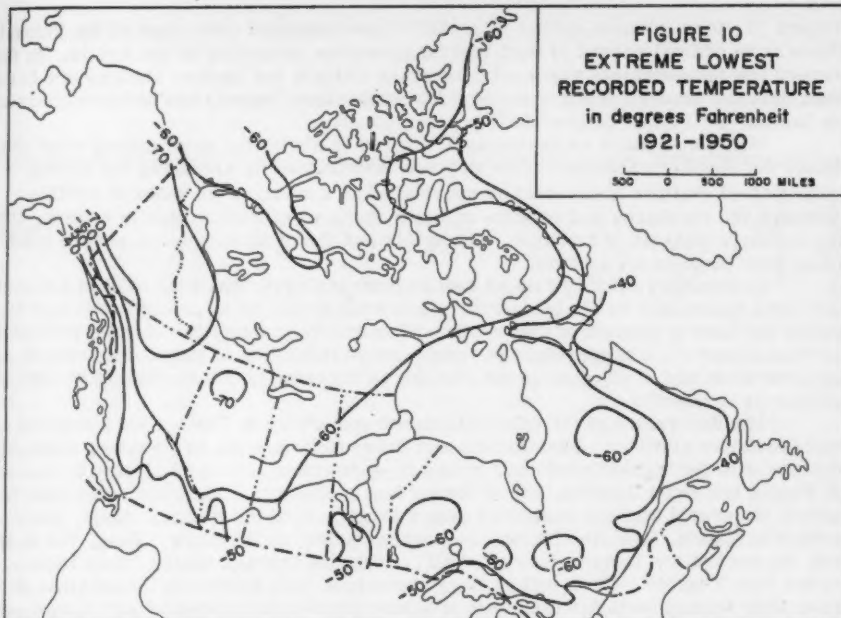


FIGURE 10
EXTREME LOWEST
RECORDED TEMPERATURE
in degrees Fahrenheit
1921–1950

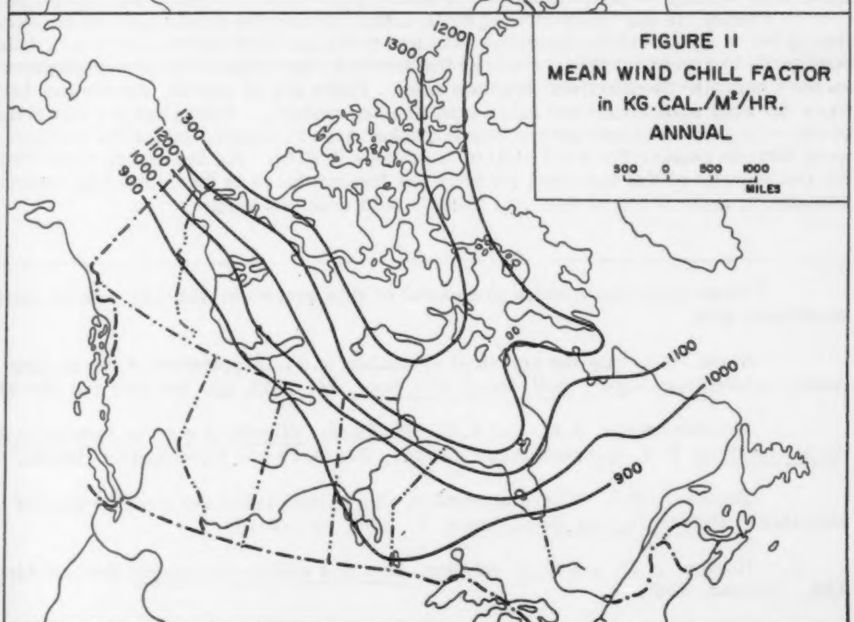


FIGURE 11
MEAN WIND CHILL FACTOR
in KG.CAL./M²/HR.
ANNUAL

Figure 10, temperatures colder than -70°F have occurred over most of the Yukon but there is no official record of such low temperatures occurring in the Arctic. In fact record low temperatures reported from some Ontario and Quebec stations are lower than those at several Arctic stations. By comparison Toronto has had a temperature as low as -26°F. and Ottawa -38°F.

With these maps as background, Figure 11 shows the mean annual wind chill factor for Northern Canada. This map was constructed by averaging the montly values at all stations and should be considered as a mean of the rates of cooling. Although the windiness and relative summer coolness of Hudson Bay is evident, the far northern stations of Isachsen, Mould Bay and Resolute have more severe conditions over the year as a whole.

In summary, it might be as well to point out again that wind chill is a computed index based only on air temperature and wind speed. It is probably the best indication we have at present of that weather characteristic which is referred to vaguely as "coldness".[1] It is therefore at least a rough indication of the cooling rate of exposed flesh and of whether or not clothing is necessary. Its usefulness at high temperatures is doubtful.

Monthly values of the wind chill factor are shown in Table 1 for a number of representative stations. Chesterfield and Baker Lake are the two weather observing stations with the highest wind chill values in mid-winter, followed closely by the Bay of Whales and Cape Denison, two of the coldest stations in Antarctica. Resolute is typical of several stations scattered over a large part of the Arctic. Alert, the most northerly station, is quite similar, at least in winter, to Winnipeg. Snag, the station with the record low temperature of -81°F., is in the average winter, very little colder than Toronto. Churchill seems to have been well chosen as the location of many field testing units for the effect of winter weather on personnel and equipment.

Finally, in any study of wind chill, attention must be drawn again to conditions during the most severe month of the year and to the parts of the country where these conditions are most marked. Study of the January map (Figure 5) focuses attention on the Churchill-Chesterfield-Resolute area. There are of course, differences between the wind chill factor and other cold weather criteria. Yukon has the distinction of recording lower temperatures than any other area in Canada, while the northernmost islands require the most fuel for a seasons heating. But the strong winds over the flat district of Keewatin and the very low temperatures in the continental interior combine to make it one of the most bitterly cold areas on earth.

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[1] Other references which are useful on this subject in addition to those already mentioned are:-

Stone, R.: "On the practical evaluation and interpretation of the cooling power in bioclimatology"; Bull. Amer. Met. Soc., 24, 1943, pp. 295-303 and 327-339.

Breckenbridge, J.R. and A.H. Woodcock: Effects of wind on insulation of Arctic clothing; U.S. Quartermaster Corps., Research and Development Branch, 1950.

Buettner, K.: "Thermal comfort as a criterion for the classification of climates"; Meteorological Monographs, 2, 1954, pp. 99-103

Burton, A.C. and O.G. edholm: Man in a cold environment; Edward Arnold Ltd., London, 1955.

TABLE 1

Mean Monthly and Annual Wind Chill Factors for Selected Stations (in Kg-cal./m^2/hr./

Month	Winnipeg Man.	Churchill Man.	Chesterfield N. W. T.	Baker Lake N. W. T.	Resolute N. W. T.	Alert N. W. T.	Snag Y. T.	Toronto Ont.	Bay of Whales Antarctica	Cape Denison Antarctica
Jan.	1490	1740	1950	1980	1800	1370	1130	1110	1072	1131
Feb.	1400	1720	1920	1870	1840	1490	1100	1110	1335	1273
Mar.	1200	1530	1720	1660	1700	1450	970	970	1615	1550
Apr.	860	1300	1480	1450	1480	1250	830	770	1722	1750
May	630	990	1160	1080	1170	1040	600	580	1706	1814
June	480	780	860	840	920	820	480	390	1660	1880
July	390	580	670	640	810	740	440	330	1948	1864
Aug.	430	610	730	650	850	790	500	340	1907	1802
Sept.	600	800	910	890	1060	1040	610	480	1934	1800
Oct.	810	1040	1190	1210	1360	1280	780	620	1670	1695
Nov.	1110	1400	1520	1520	1520	1370	960	820	1374	1426
Dec.	1370	1680	1780	1790	1650	1390	1060	1030	1078	1237
Annual	898	1181	1324	1298	1347	1169	788	713	1585	1602

TRACING ROSS ACROSS BOOTHIA[1]

J. Keith Fraser

Geographical Branch, Dept. of Mines and Technical Surveys

Summary of Voyage by Ross, 1829-1833

The Victory sailed from Scotland on June 13, 1829, with the object of discovering a northwest passage. After visiting settlements in west Greenland, the ship entered Lancaster Sound, reaching Prince Regent Inlet on August 10. The vessel proceeded south along the east coasts of Somerset Island and Boothia Peninsula until September 29 when it was frozen in at Felix Harbour in Lord Mayor Bay. This was the base of the expedition for two years and during this period nine journeys were made by sled to explore the area. In the fall of 1831, the ship was moved only as far as Victoria Harbour east of Thom Bay and on May 18, 1832, the ship was abandoned and the party sledged north to Fury Beach on Somerset Island. Here they spent the next winter and in August, 1833, they embarked in the small boats and were picked up in Lancaster Sound by a whaling vessel which returned them to England.

Results and Discoveries of the Expedition

This expedition mapped the east coast of Boothia Peninsula as far south as Lord Mayor Bay and the west coast from Spence Bay to Cape Adelaide. New land was discovered to the west, the north coast of King William Island, and it was named after King William IV. The expedition did not discover Bellot Strait which separates north Boothia from Somerset Island and they returned to England under the impression that a western passage existed only north of Somerset Island. They had not proved that Boothia Peninsula was part of the mainland or that King William Land was an island. Despite the reports of natives who agreed that there was no passage to the south, no proof of this existed until John Rae traversed the coast from Pelly Bay to Lord Mayor Bay in 1847.

The journal of the expedition[2], although heavy reading, contained much new information concerning the Eskimos. Ross returned with the distinction of having spent four winters in the Arctic, bringing his expedition back with the loss of only three men, two of whom died from causes not directly attributable to northern hardships. This perhaps was a matter of good fortune rather than good management, if the account of this expedition prepared from the report of a junior member is to be believed.[3] It seems likely that the success and results of the expedition should be attributed to the character and perseverance of James Clark Ross rather than to his uncle. The Ross map of Boothia Peninsula, however, sketchy as it was, remained the best published map for over one hundred years (Figure 1). Even today, much of

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1 Presented at the Seventh Annual Meeting of the Canadian Association of Geographers Ottawa, 1957, and published with the permission of the Director, Geographical Branch, Dept. of Mines & Technical Surveys.

2 Ross, Sir John: Narrative of a Second Voyage in Search of a Northwest Passage, 2 vols., London, 1835.

3 Huish, R.: The Last Voyage of Capt. Sir John Ross, R. N.... London, 1835.

the latest published revision of the eight mile to one inch National Topographic Series is based on the map in his journal.

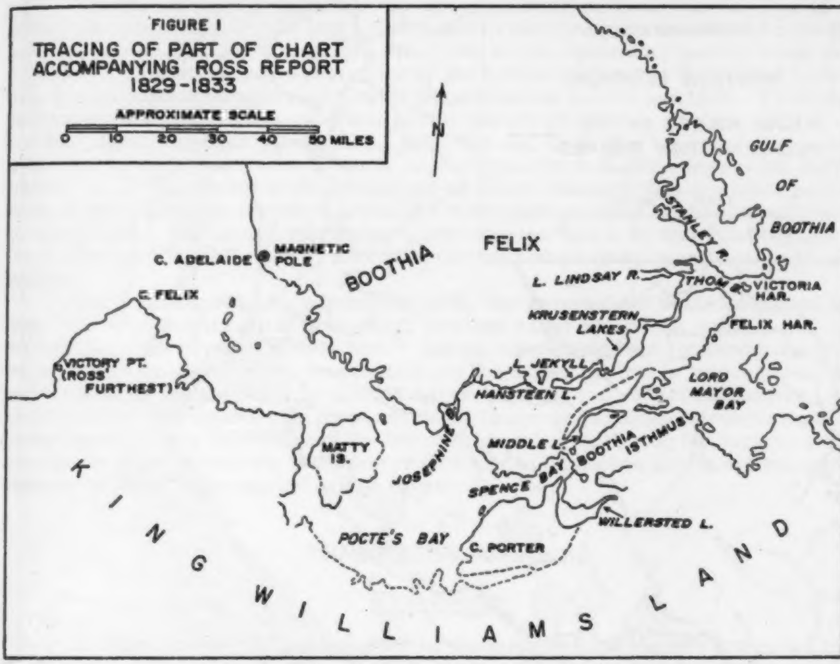

FIGURE I

TRACING OF PART OF CHART ACCOMPANYING ROSS REPORT 1829-1833

Later Explorations on Boothia

John Rae travelled from Repulse Bay to within sight of Lord Mayor Bay in 1847.[1] M' Clintock traversed the west coast of Boothia from Bellot Strait in 1859, although he did not visit Josephine or Spence Bays.[2] Amundsen's expedition crossed from King William Island to the site of the magnetic pole (as established by Ross) in 1904 but added little to the mapping of the area.[3] In 1924, Rasmussen crossed Rae Strait to visit native camps near the Murchison River.[4] He did not visit Boothia isthmus but obtained several native maps of this area. The report of Burwash also

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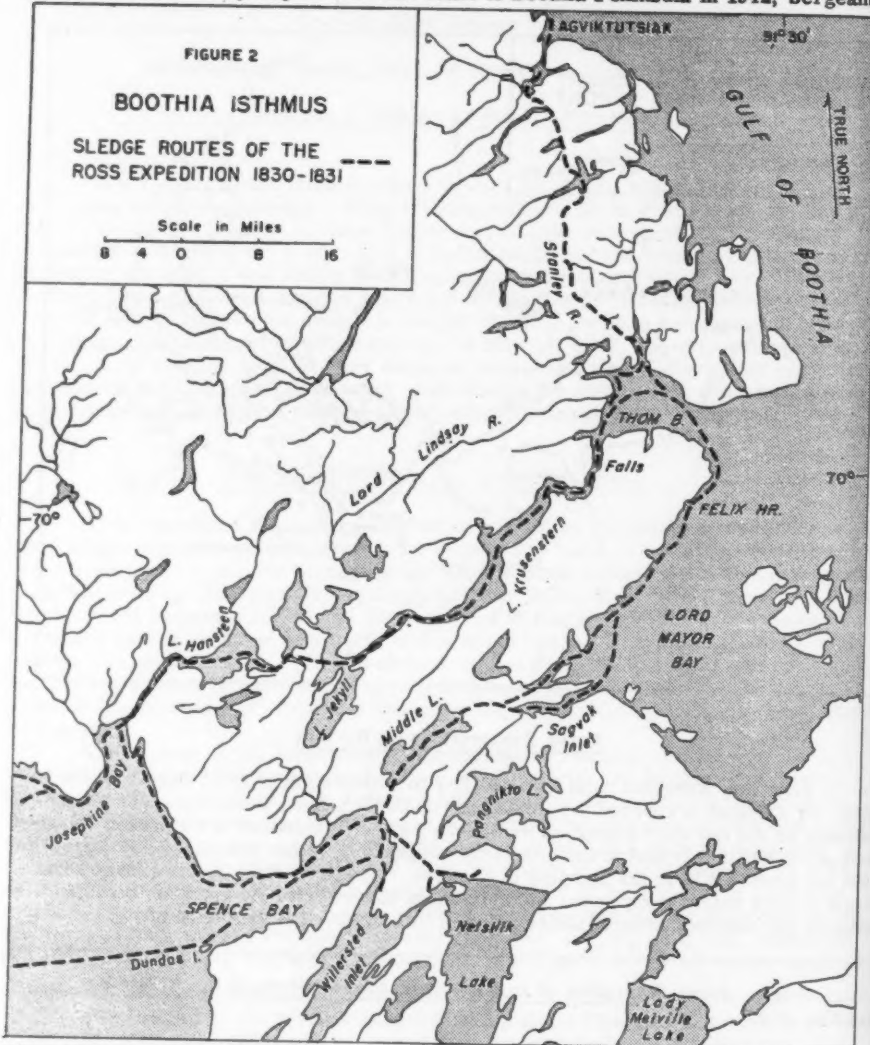
[1] Rae, John: Narrative of an Expedition to the Shores of the Arctic Sea, London, 1850.

[2] M' Clintock, F. L.: Voyage of the Fox..., London, 1859.

[3] Amundsen, R.: The Northwest Passage, 2 vols., London, 1908.

[4] Rasmussen, K.: "The Netsilik Eskimos", Report of 5th Thule Expedition 1921-24, 8, No. 1-2, Copenhagen, 1931.

contained a native map of Boothia.[1] During the wintering of the R.C.M.P. vessel ST. ROCH at Pasley Bay on the west coast of Boothia Peninsula in 1942, Sergeant



(now Superintendent) Henry Larsen and Constable P.G. Hunt sledged north to Creswell Bay, down the east coast of Boothia to Pelly Bay and back to the ship by way

[1] Burwash, L.T.: Report of Exploration & Investigation along Canada's Arctic Coast Line...1925-26, mss., Dept. Interior, Ottawa, N.D. (ca. 1927).

of Gjoa Haven on King William Island.[1] None of these expeditions added to the knowledge of Boothia isthmus except from second hand descriptions obtained from natives, nor were there any detailed published accounts of the geography of the area.

Boothia Isthmus remained unvisited by scientific parties from the time of Ross until quite recently. In 1948, the Hudson's Bay Company established a trading post at Spence Bay, thus providing a base from which exploratory parties could work. The R.C.M.P. built a police post close by the following year and the Roman Catholic and Anglican missions built churches in the settlement in 1954 and 1955. From this settlement, the police made extensive winter patrols on Boothia, visiting native camps. Roman Catholic priests from Pelly Bay and Thom Bay also travelled in the area, and several visits were made by Anglican padres to Boothia from north Baffin Island. L.A. Learmonth probably carried out more research than any other person in the area, but except for short articles,[2] the results of these travellers seldom were published. Little new was known concerning the people or their country and there were still no new maps on which the journeys of the Ross expedition could be traced.

During the spring and summer of 1953, two geographers in the employ of the federal government travelled by dogsled, foot and canoe across the isthmus and through the lakes north of Spence Bay.[3] Among other objectives, observations were made on Eskimo settlements, movements and the names applied to various localities and features by the natives. To facilitate travel and the mapping of information, the party carried with them a map prepared in the Geographical Branch from aerial photographs. Using this map and the information collected during the survey, it was possible to trace accurately the journeys of the Ross expedition and to determine the features to which Ross applied names (Figure 2).

TRACING THE JOURNEYS

First Journey

In 1830, on April 5, accompanied by the mate Blankey and two Eskimos, James Clark Ross, set out from the ship at Felix Harbour and traversed the north coast of Lord Mayor Bay to an inlet where they camped to wait out a blizzard (Figure 3).

> "The hut was built on the south shore of an inlet about three miles long, lying on a west-south-west line. On each side, the land presented high and rugged shores of granite; and a considerable river entered on that which was opposite to us, at about the distance of half a mile. The name which the natives gave to this, was Ang-ma-look-took, and they described it as abounding in fish,

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[1] Larsen, H.A.: Reports and other Papers relating to the two Voyages of the R.C.M. Police Schooner ST. ROCH through the northwest passage", RCMP Reports, 1945, Ottawa.

[2] Learmonth, L.A.: "Interrupted Journey", Beaver, Sept., 1951, pp. 20-24; "Adventure in the Night", Beaver, March, 1946, pp. 36-37; "Ross Meets the Netchiliks", Beaver, Sept., 1948, pp. 10-13.
Gibson, W.: "The Victory Relics", Beaver, Dec., 1929, pp. 311-112.

[3] This party was fielded by the Geographical Branch, Dept. of Mines & Technical Surveys, and was composed of J.Keith Fraser and Camille Laverdiere.

in the summer time. The name of the inlet, in the language of the country, is Too-nood-lead..." (p. 311) [1]

These names correspond closely with those still in use as obtained in 1953, Angmaluktok and Tunudlik.[2] The former refers to the lake as well as the river and means "that which appears round". From the summit of the high hill east of this lake, the low western shores may give that impression, although a glance at the map shows that the lake is by no means circular in shape. Tunudlik signifies "that which is far away", and has no apparent significance. Fish weirs were noted on the river flowing from Angmaluktok Lake and the above description of the inlet leaves no doubt that this was the camping place of Ross. Instead of ascending this river to Angmaluktok Lake, the party proceeded to the head of the other arm of the inlet, known as Netsiksiuvik Inlet. (Figure 4).

> "After crossing a neck of land, about three miles broad, and occupied by two small lakes, which, as we were informed, were well stocked with fish, we again descended upon the salt-water ice, which the guides described as belonging to the head of a maritime inlet to which they gave the name of Tar-rio-nit-yoke. The meaning of this phrase, however, is "not salt water": so that it is probably a place into which there runs a river, or rivers, so considerable as to justify this name. Thus it is that its exit, or mouth, is also termed by them Shag-a-voke, which means "it runs fast"... We halted on a small islet in the north-west corner of this bay" (p. 312)

The place where the river flowing out of Middle Lake enters this inlet is called Tagiungitok, meaning "tastes salty". This is a well-known native camping ground, fish being taken by liesters at weirs in the stream. This campsite is notable by the great number of old graves scattered on the terrace on the north side of the river. The water in the inlet is brackish, due to the constriction near the head of the inlet which allows the sea to enter only at high tide. Netsiksiuvik refers to the head of the other inlet of which Tunudlik is an arm, and means "the place to hunt seal". Here is another camping ground, occupied in the summer, when seals enter the inlet and may be shot from the shore.

> "From this place we now continued our course directly inland; ascending the bed of a river, and passing several narrow lake; travelling through deep snow for the space of four or five miles. Our progress was necessarily, therefore, very slow, until we reached the banks of the furthest one, to which they gave the name of Ty-shag-ge-wuck..." (p. 313).

This is the common native route today, (Figure 5) proceeding up the river and its associated lakes for several miles and then cutting overland to the shores of Middle Lake, the Ty-shag-ge-wuck of Ross and the same as Tahiyuak or "big lake". This

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[1] Quotations throughout are from the journal of Ross (cf. footnote 2) unless otherwise credited.

[2] Eskimo place names were obtained from Adam Tootalik, special constable at Spence Bay, and other natives, and the spelling and interpretation were checked by Mr. Leo Manning, Department of Northern Affairs and National Resources (See Appendix).

Figure 3. (left)

Looking west towards Middle Lake. Taginungitok is at the end of the long inner portion of Sagvak Inlet and Tunudlik appears as the ice-free arm of Netsiksiuvik Inlet leading towards Angmaluktok Lake. (R.C.A.F. photo.)

Figure 4. (below)

Looking east towards Lord Mayor Bay. The locality of Tagiumgitok is at the stream mouth entering the head of Sagvak Inlet. The little islet off the mouth of this river is that on which Ross camped. (R.C.A.F. photo.)

name is one of the most common in Eskimo territory, there being at least one and often several of this name in each locality. Another Tahiyuak, the present Lake Hanstein, lies on Boothia near Josephine Bay. Others are found on King William and Victoria Islands, on Melville Peninsula and Baffin Island. Because of its widespread use, lakes of this native name are and should continue to be given other names, to

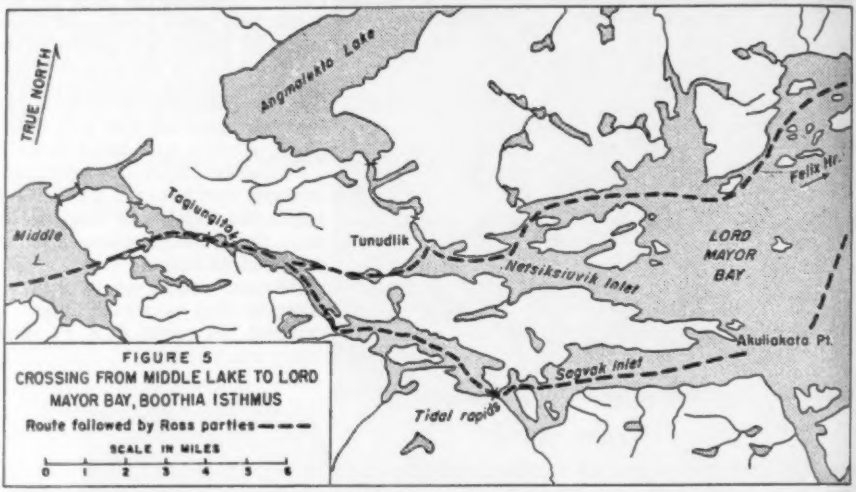

FIGURE 5
CROSSING FROM MIDDLE LAKE TO LORD MAYOR BAY, BOOTHIA ISTHMUS

distinguish them from the lake already having this name adopted for it in central Victoria Island.

Camp was made at the west end of Middle Lake (so named by Ross on a subsequent trip) and the following day the party crossed the portage to salt water again at Spence Bay. (Figure 6).

> "...after passing two small narrow lakes, called King-uck from the hilly country by which they were bounded, we arrived by a short and steep descent at the place called Pad-le-ak; a word which means 'journey's end' ". (p. 314).

The locality about the present settlement at Spence Bay is known today by the Boothia Eskimo as Padliakjuk, a name for which the local natives could give no interpretation. The long lake east of the RCMP detachment is known locally as Kinguk, resulting, as Ross points out, from the steep rocky cliffs along its shores.

Ross crossed the inner part of Spence Bay, proceeding to the southwest and gradually turning to the southeast. (Figure 7).

> "...passing first a small lake where I procured a meridian altitude of the sun, and traversing a low shore of limestone, we arrived at the great lake of Nei-tyel-le at one o'clock...The east shore of this piece of water presented a ridge of granite hills...we pursued our course to the southward, soon reaching the banks of a river... From the information of the guide...it runs into the sea in a direction to the south-west of this islet (in the river), flowing out of the southeastern end of the lake which we had passed" (p. 317).

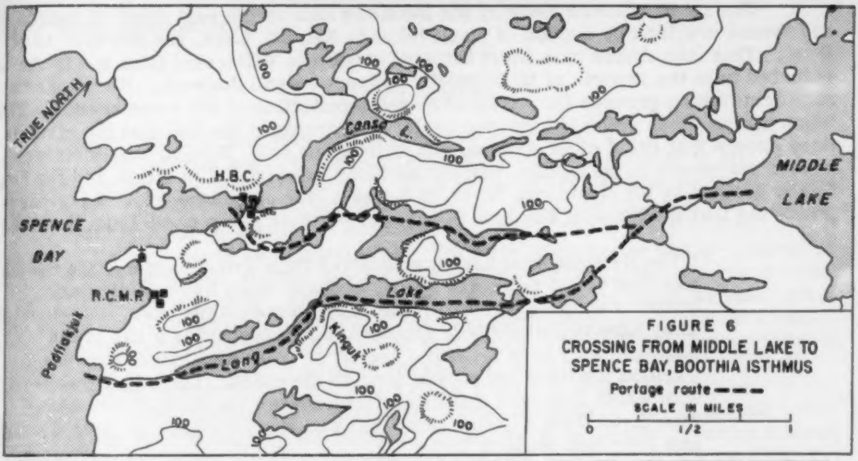

FIGURE 6
CROSSING FROM MIDDLE LAKE TO SPENCE BAY, BOOTHIA ISTHMUS

Figure 7. Looking east, showing the prominent scarp along the north side of Netsilik Lake and the lowland through which the Netsilik River flows to Willersted Inlet. (R.C.A.F. photo.)

The route followed today by the Netsiliks follows the east coast of Spence Bay and thence overland by a chain of small lakes to Netsilik Lake, the Nei-tyel-le of Ross. This lake drains by a short but wide stream to Willersted Inlet and is the lake referred to in the reports of M'Clintock, Rasmussen and Burwash. Here there are excellent fishing grounds for Arctic char and a collection of old stone houses. The name means "that which has its own seals", referring to the fact that the river is deep enough that seals often come up into it from the sea. Similar nomenclature occurs elsewhere in the Arctic, namely Netilling Lake on Baffin Island and the Seal Lakes drained by the Nastapoka River on the east side of Hudson Bay. Rasmussen points out that the Netsilik Eskimos did not derive their group name from this lake.

> "The Netsilingmiut have not received their group-name: "the people who live where there are seals" because seals were particularly abundant in their territory; this is by no means the case, unfortunately. They have more probably received it because, after a life in the interior, they have for some reason or other separated from the Caribou Eskimos and moved down to the coast. The inland dwellers, with whom they still maintained intercourse via Back River, have then given them a group-name that was characteristic of their country and their new mode of living". [1]

The sketchy description by Ross of this locality agrees well with the physiographic features. There is an outstanding and remarkably straight linear along the eastern shore of Netsilik Lake, forming an abrupt division between the drumlinized lowland on the west and the rugged granitic plateau rising some 400 to 500 feet on the east. The term "limestone" is used commonly throughout the narrative and does not necessarily refer to bedrock exposures, but often merely to surface material composed mainly of shattered limestone fragments.

Returning to Spence Bay, James Ross ascended a prominent hill near Padliakjuk (probably the hill overlooking the RCMP detachment) and from here gazed westward over Spence Bay. He noted the high land rising along the northwestern shore and gave the name of his sister, Isabella, to this cape. The local name of this feature is Kingnakjuak, meaning "high hill". These western uplands stand in strong contrast to the central lowland between them and Padliakjuk. The party then returned to the ship by the same route as on their outward journey. This marked the first crossing of Boothia Isthmus by a European.

Second Journey

A short trip was made by James Ross towards the end of April, 1830, to Sagvak Inlet, in the hope of finding a passage to the western sea discovered on the previous trip (Figure 5). Though the natives assured them that no such passage existed, James Ross traversed the inlet to its head at Tagiungitok, thus satisfying himself that the natives were correct. The cape separating the two inlets of Netsiksiuvik and Sagvak was called by the natives "Ac-cood-le-rook-took", according to Ross (p. 327). This has now been named Akuliakata Point, referring to the shape of the feature somewhat resembling the bridge of a nose. Ross passed the rapids in lower Sagvak Inlet but made no observations concerning the effect of the tide on the current at the rapids. He believed that the rapids were due entirely to the heavy spring run-off, at which time the natives congregated there for spring fishing. However, observations in 1953

[1] Rasmussen, K., op. cit., p. 85.

indicated that at low tide the constriction created a strong rapids, while at high tide a state of slack water exists.

Third Journey

Between April 27 and May 4, 1830, James Ross made a trip to the north (Figure 2) along the east coast of the peninsula to a locality mentioned to him by natives and called "Aw-wuk-too-te-ak". This is the native camp at the mouth of the Agnew River, a favourite sealing and fishing place, mentioned by Larsen as "Arvik-tootsiak"[1] and spelled by Manning "Agvitutsiak", "the place of many whales". Rasmussen lists the place as "Arfertociaq - the little place where whales abound".[2] According to the Eskimos visiting the VICTORY, "beyond that point, the coast turned and extended to the northwest, and...this was the only route by which we could get round to the sea of Nei-tyel-le" (p. 338). Ross appears surprised that none of the natives had ever used this passage of which they spoke in travelling from Agvitutsiak to Netsilik Lake. In the light of present knowledge, the passage refers to Bellot Strait, 100 miles farther north, and would entail a quite roundabout trip to reach Spence Bay. Boothia Isthmus is comparatively easy to cross by way of Middle Lake and so it easily understood why the Netsiliks preferred to make this crossing instead of passing through Bellot Strait. The comparative lack of seals and of good fishing rivers along the west coast of Boothia is another reason why the natives for the most part avoided this coast.

James Ross crossed Thom Bay to the inlet into which the Stanley River flows.

> "At two in the afternoon we entered an inlet which the guide called An-ne-reak-to, running in a north-north-west direction, and being about a mile wide at the entrance. The eastern cape was named by him Ne-ak-kog-e-nek; an appelation derived from a rock projecting through the shingle, which bore a fancied resemblance to a human head...We continued, hence, to journey along the western shore of this inlet, till we entered the mouth of a river, about a mile and a half from its entrance, turning off to the west-north-west, and leaving on our right the termination of An-ne-reak-to. This part of the river is called Ac-cood-le-it-pang-ut..." (p. 345).

This inlet is today known as Anareaktovik, pertaining to a toilet, and the river as Akudlik, "the middle place". Rasmussen lists the first place as "Anariartorfik", giving much the same meaning.[3] A camping ground on the eastern shores of Thom Bay is today called Niakunak, probably similar to the name given by Ross as Ne-ak-kog-e-nek. On the return from Agvitutsiak, Ross named the Stanley River, which he describes as not exceeding ten miles in length. He refers here, however, to the lower portion of the river below the first large lake; tributaries to this lake extend westward for some forty miles.

This trip to Agvitutsiak proved nothing except that if a passage existed, it must be sought farther north. Ross was hampered by poor visibility and was unsatisfied that he had completely disproved the presence of a passage; accordingly, he made

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[1] Larsen, op. cit., p. 84.

[2] Rasmussen, op. cit., p. 106.

[3] Rasmussen, op., cit., p. 106.

another trip up this coast the following year with no more success (see account of the eighth journey). Summarizing this journey, John Ross indicates that Cape Manson, near the Agnew River, was then believed to be the northernmost point of the mainland, and the journal states that James Ross' guide "had conducted him to the narrow channel leading between the two seas... situated a little to the northward of Elizabeth Harbour." (p. 378). It has been shown, however, that James Ross was still 100 miles south of Bellot Strait. Nevertheless, this statement indicates that at this stage, John Ross seemed confident that a passage existed south of Somerset Island, marked as "North Somerset" on the map accompanying the report of the expedition.

Fourth Journey

On May 17, 1830, James Ross set out from the ship to explore to the west of Spence Bay. Following the same route across the isthmus as on his previous trip and naming Middle Lake, he reached Spence Bay at Padliakjuk and proceeded to Cape Isabella, (Figure 8) which he describes:

> "Cape Isabella rises abruptly, and often precipitously, to about five hundred feet above the level of the sea, and is formed of grey granite, presenting patches of vegetation, which, for this climate, seemed to have been unusually luxuriant in the past summer." (p. 404).

Aneroid readings taken in 1953 show that the hills at Cape Isabella are only a little over 200 feet above the sea; from its foot, however, the cape gives the impression of being much higher. Ross continued along the coast:

> "...we set out at six in the evening; pursuing our route close along shore, under the projecting point of limestone which skirts Cape Isabella, and extends along this shore for some miles, where it is broken into capes and inlets by means of long ridges of that rock... After a fatiguing day's journey of twenty miles, we halted soon after four in the morning...For the last four or five miles of this journey, the coast was formed of granite, containing large crystals of felspar, with garnets; the hills, at a short distance from the sea attaining the height of six or seven hundred feet." (p. 406).

There had been some discussion among the party as to whether they had actually been travelling on the sea, the reason being the absence of a tidemark along the shores. The tides in Spence Bay are much lower than those on the east coast of Boothia, being only one or two feet compared with six to ten feet, and along a shelving coast such a small tide is not readily visible. Ross mentions again the presence of limestone. Fraser and Laverdiere traversed this coast in 1953 by canoe in early September and nowhere discovered sedimentary rocks in situ. However, between Cape Isabella and Artists Bay, the shoreline is composed of large, angular pieces of yellow or buff limestone, greatly fragmented and mantling the crystalline rocks which compose the western upland. Ross camped at Artists Bay, where he describes accurately the coast and inland hills of granite. Climbing a nearby hill, he saw to the north-west the entrance to Josephine Bay (named during a later journey) and the low limestone (here truly in situ) plain which forms its western shore (Figure 9). Exploring this bay to its head, Ross came upon the estuary of a river which he named after Nicholas Garry. The country inland was surveyed from an adjacent hill which he estimated as one thousand feet high; this is several hundred feet higher than the true

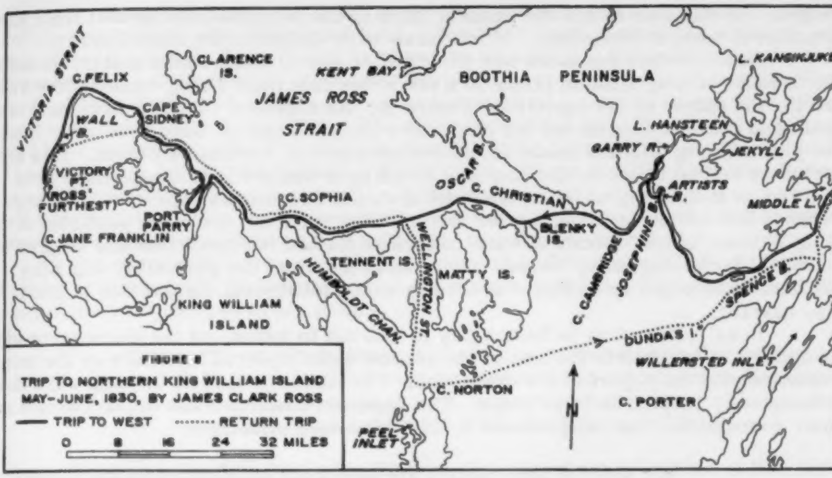

Figure 9. Looking west over Josephine Bay, showing the Garry Lakes and River and the sedimentary formations along the west coast of Boothia Peninsula in the the distance. (R.C.A.F. photo.)

height. He was able to see the chain of lakes to the northeast, noting that their northern shores were of limestone. These lakes were visited on the ninth journey.

Ross crossed the strait now named after him to Matty Island and traversed the north coast of King William Island to a few miles past Cape Felix, named after Felix Booth, the patron of the expedition (Figure 8). He supposed this land to be part of the mainland coast of Canada and his map shows King William IV Land continuous from the present King William Island to the southern part of Boothia Peninsula. It is unfortunate that he failed to discover Rae Strait as it was the lack of a passage here marked on Ross' map which no doubt led Sir John Franklin to believe that the best route to the western approaches led through Victoria Strait along the west side of King William Island, a body of water notorious for bad ice conditions and clogged with islands. In the Appendix, however, John Ross mentions the possibility that King William Land might be an island according to the subsequent discoveries of Back (p. cxxviii).

Ross' return trip to Spence Bay is difficult to follow, as the placenames which he applied to features in the text of his account were replaced by others on the map accompanying the report of the expedition. The names plotted on the map were those subsequently adopted on later maps. The Appendix contains a list of placenames and their coordinates, the list prefaced by an explanatory statement:

> "This list will also explain the omissions and discrepancies between the narrative and the chart, which arose from my unavoidable absence, whilst Commander Ross's narrative was printing; and by the chart having been printed and examined by His Majesty before I had received Commander Ross's narrative" (p. LII).

The thin dotted line of his return journey indicates that he crossed from the south point of Matty Island almost to the Dundas Islands at the entrance to Spence Bay, thence northeast to Cape Isabella and on to an islet near the head of Spence Bay where John Ross had left some provisions for his party four days previously (See account of the fifth journey). Here James Ross wished to discover where the river flowing out of Netsilik Lake entered the sea and he made a short excursion to the entrance of what was named on the map Willersted Lake, now Willersted Inlet.

> "Leaving the party, therefore, to work at such repairs of various articles as were now wanted, I set out with this man, and after travelling about five miles to the south-south-westward, we arrived at the entrance of an inlet somewhat less than a quarter of a mile in breadth, but enlarging considerably in its progress. This strait he called Ik-ke-rush-yuk, a name derived from the rapidity with which the water rushes out in the summer; the stream being fresh and good for drinking, as he said, though at this point, where I tasted it, I found it very salt...I proceeded along the left shore of the inlet, about four or five miles; and, ascending an elevated ground, gained a commanding view of the inlet, through I could not be sure of the continuity of the opposed and remote shore. My conclusion, however, from the report of the Esquimaux, was, that the west branch of the river in question must fall into the sea somewhere to the southward of Point Scott.
>
> The shore on which I stood had gradually changed its trending from south to south-east by east; and at two or three miles beyond, the inlet appeared to be not more than half a mile broad, whence it turned more to the north-east; and here I could see the spot I had visited on my first journey to this place." (p. 429).

Ross was apparently confused concerning the configuration of Netsilik Lake and its relationship with Willersted Inlet. The Point Scott of which he writes is probably synonymous with Cape Porter as shown on the map. It is puzzling that Ross felt it necessary to show another outlet for "Willersted Lake" debouching into Rae Strait south of Cape Porter when he had stood on the shore of a passage known to connect the same "lake" with Spence Bay. The river connecting Netsilik Lake with Willersted Inlet is named on Ross' map as the Jane River and tentatively shown as joined to "Lady Melville Lake", the present Netsilik Lake. There is little doubt that Ross was actually describing the passage leading to Willersted Inlet. He states that it was salt, and the appelation given the feature Ik-ke-rush-yuk corresponds to the name Ikikisak provided by the present Spence Bay Eskimos, meaning "a narrows".

The party returned by way of the portage at Padliakjuk to Middle Lake and arrived at Tagiungitok on June 11 to find the stream in full flood and the ice at the head of the inlet covered by its waters.

> "Not a dry spot remained anywhere; for there being no tide powerful enough to break up the frozen barrier towards the sea, this disengaged water could find no passage to it, except through a few seal holes which were quite incompetent to drain it off." (p. 433).

Wading across this bay to the portage, Ross arrived at the head of Netsiksiuvik Inlet to find better travelling conditions:

> "In this bay...the travelling was among the easiest that we had found. The water, which had here also overflowed the surface, had dissolved the snow, and afterwards escaped through the fissures beneath, which had been produced by the rise and fall of the tide." (p. 434).

Here again is evidence that the inner part of Sagvak Inlet, Tagiungitok, is separated from Lord Mayor Bay by the tidal rapids near the entrance. In Lord Mayor Bay itself and in the attached Netsiksiuvik Inlet, well-formed tide cracks exist along the shores, whereas, as Ross observes and as Fraser and Laverdiere found in mid-June, 1953, such tide cracks do not occur above the rapids in Sagvak Inlet.

Fifth Journey

During James Ross' trip to King William Land, Captain John Ross had made a trip to the west side of the isthmus in support of his junior's party. It is evident from his report of this trip that the altitudes measured or estimated by his nephew are much more reliable than his own. John Ross (perhaps because of an error in the text), calculates that Tagiungitok or inner Sagvak Inlet is 80 feet above the level of Netsiksiuvik Inlet, whereas there is at most a difference of five feet at mean low tide.

> "Landing at the bottom of this channel (Netsiksiuvik Inlet), we proceeded southwestward, and, at the distance of half a mile, reached a lake about forty feet above the level of the sea; following the bed of the river to it, as that was still frozen over... Following upward from it, we came to another of similar dimensions, a hundred feet higher, which discharges itself into the one below. Thence proceeding in the same direction until we had attained thirty feet more of elevation, we descended about ninety feet to the sea of the gulf of Shag-a-voke, and about seven miles from its entrance". (p. 383).

Proceeding up the river and crossing Middle Lake, they crossed the portage to Spence Bay (Figure 10). Here again John Ross miscalculated:

> "We now travelled south-eastward for a mile, and gained what we judged the highest elevation on our track, which I conjectured to be three hundred feet above the level of the sea. Thence we came to a narrow lake tending in the same direction, which brought us in sight of the western sea at Padliak, arriving at it after a descent of a mile." (p. 385).

Middle Lake is no more than twenty feet above the sea (John Ross later estimated its elevation as thirteen feet) and the lowest point on this portage no more than fifty (Figure 6). Even the highest ridges between Middle Lake and Spence Bay scarcely reach 150 feet and it is likely that the party did not depart from the usual and easiest route. As an experienced seaman, John Ross can hardly be excused such exceptional discrepancies, and these errors perhaps lend somewhat more credence to the reports of the deficiencies of John Ross which were brought out in the report by Huish (cf. footnote 3).

On this trip, John Ross named Spence Bay after a relative. He mentions the presence of inuksuks, the heaps of rocks or single rocks placed on end by the Eskimos to give the appearance of persons, and used in driving caribou along certain valleys in their hunts.[1] Cape Isabella was noted to be called "Kingaruick" corresponding to the present appelation of Kingnakyuak, "high hills". The description of the Netsilik Lake area by John Ross is, to say the least, most confused. He gave the name to Lady Melville to one of the lakes, most probably to Netsilik Lake. This name has now been applied to the large lake some twenty miles southeast of Netsilik Lake and the name Netsilik officially adopted for the one of that name by the natives, because of the common use of that name in the area and its importance in local Eskimo culture and history. John Ross also mentions the presence of stone houses at "Neitchillee", indicating that he visited the river flowing out of Netsilik Lake where these houses are located.[2] He ascended the bluff along the northern side of the lake and describes the high land and the streams emanating from it. The natives informed him that:

> "there were many rapids and waterfalls between the lake and the eastern sea, and that a canoe could not ascend. The guide said that there was also a river at the other end, which, he believed, was not navigable, and which ran into the western sea; but that it was very far off." (p. 390).

There would certainly be some difficulty in crossing from Netsilik Lake to the Gulf of Boothia by canoe, especially by the large river entering the lake at its northeast corner. A small stream enters Netsilik Lake at its southern extremity, emanating from a chain of little lakes, from which another small stream flows south to Shepherd Bay. It is unlikely that Netsilik Lake has an outlet other than the one debouching into Willersted Inlet.

On his return trip, John Ross outlines the measurements of Middle Lake which he calls "Teijgriak", the present Eskimo name of Tahikjuak, "big lake". After

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[1] Harrington, R.: "Spring Break-up at Boothia", Can. Geog. Jour. XLVI, 1953, p. 162.

[2] Rasmussen, K., op. cit., p. 115
See also Harrington, R., op. cit.

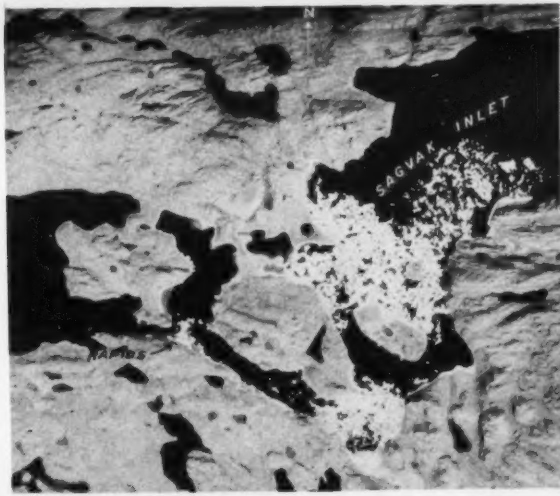

Figure 10. (right)

Looking east across the isthmus, showing Middle Lake and the portage to Spence Bay. The Hudson's Bay Company post is located at the head of the little inlet of Spence Bay at the right.
(R.C.A.F. photo.)

Figure 11. (above)

The rapids in Sagvak Inlet located at the south end of the westernmost peninsula. The scattered ice in this picture is all below the rapids and so at sea level. (R.C.A.F. photo.)

arriving at Tagiungitok, the party traversed Sagvak Inlet to Lord Mayor Bay. (Figure 5).

> "As the gulf, inlets, and strait of Shag-a-voke had not yet been regularly examined, I now changed our course to the south-eastward; and, after travelling two miles through a very deep snow, we came to the strait which separates the gulf, or upper part, from the sound. Here, on each side, there are precipices of nearly three hundred feet high, the general breadth of it being three-quarters of a miles...About the middle, it was half a mile wide, and bounded by high mountains...At the second strait, which separates the middle of the inlet from the lower part, or bay...a point of land... projecting from the north side, seems to block out the sea; looking like an island, but connected with the shore by an isthmus, and leaving the breadth of the water, in this place, about a hundred feet...At this division of the water, there is a reef of large stones, resembling a mill-dam, being placed diagonally...The isthmus is covered with circles of stones being the remains of native houses....." (p. 394).

In 1953 Fraser and Laverdiere descended the inlet by canoe as far as the rapids (Figure 11). Beyond that point, the outer part of Sagvak Inlet was choked with ice on August 1st. Marine terraces form the "isthmus" of Ross, exhibiting several stands of the sea. The fish weirs at the rapids have fallen into disuse, probably being partially destroyed by ice movement. Tent rings were scattered on the treads of the terraces. An old caribou blind of rocks still stands near the water at the head of the rapids. Rasmussen notes this place as "arwak" - the two streams" and mentions that Tunit (Thule culture) ruins are located nearby.[1] These ruins were not discovered in 1953, nor did the Boothia Eskimos know of any in that locality.

Sixth Journey

The last journey from the ship in 1830 was a fishing trip to Thom Bay (Figure 2). James Ross spent from June 23 to July 3 probably at Kogaluktok Falls but there is no detailed account of this trip. John Ross visited the inlet Anareaktovik previously examined by his nephew and from a hill nearby obtained a view of Mary Jones Bay. From here a native guided them to the mouth of the Lord Lindsay River (Figure 12) known locally today as Ikpik, the river and its long lake Tahik. After purchasing fish from the natives there, the party returned to the ship on July 3.

> "The river which we had visited is called by the natives Tachik, and is only fifteen miles from the ship, though its circuitous course had made it twenty to us. It is about five hundred feet wide, and from six to ten deep; the bottom full of large blocks of granite, and the current running strong at first, but diminishing before we had left it. There was a rapid also about two miles up the stream, preventing its navigation: while the natives informed me that it ran out of a large lake which was supplied by others at a greater distance." (p. 453).

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[1] Rasmussen, K., op. cit., p. 105.

Figure 12. (above)

Looking east over Thom Bay Kogaluktok Falls at the exit of Krusenstern Lake is not shown but the inlet into which it flows appears at the lower right.
(R.C.A.F. photo.)

Figure 13. (left)

Looking east over the eastern half of Krusenstern Lake, showing the abrupt transition between the rugged eastern uplands and the central plain. (R.C.A.F. photo.)

This is a permanent settlement of the Boothia natives today, their camping ground being located on a level alluvial terrace on the north bank of the river mouth, where Ross found them. A small Oblate mission stands on the point, presently unoccupied.

No trips were made during the summer of 1830, most of the time being spent in attempting to free the ship from the ice in preparation for the return to Lancaster Sound. However, ice conditions prevented this and the ship was frozen in again at Sherriff's Harbour only a few miles from Felix Harbour. The following April, (1831), sled journeys recommenced.

Seventh Journey

A short trip was made by John Ross on April 22 and 23 to Thom Bay to procure fish from the natives, passing on the way the point known as Niakunak, spelled by Ross, "Neokouak" (p. 515). The same point was visited by James Ross on April 20 and spelled by him "Neak-kog-nak" (p. 521).

Eighth Journey

The eighth journey from the ship was undertaken by James Ross in order to make a better examination of the coast near Agvitutiak in the hope of finding a passage to the western sea. Ross investigated the small inlets as far as the mouth of the Agnew River and the report adds

> "it was plain that there could be no passage nearer than the latitude of 71° 55', where there is another great inlet." (p. 520).

Bellot Strait is located along the east coast at 72° and so Ross was on the right track. It is unfortunate and a little puzzling that a better investigation of Brentford Bay was not undertaken during the retreat of the expedition north along this coast in 1833. It remained for Kennedy and Bellot to discover Bellot Strait in 1852.

Ninth Journey

Both John and James Ross took part in this trip, during which, in company with natives, they sledged across the peninsula along the chain of large lakes north of Spence Bay, from Thom Bay to Josephine Bay (Figure 2). Reference is made to the "mountain Kakoloktok", being presumably the high hills near the outlet of the Krusenstern Lakes, where the falls are now officially known as "Kogaluktok Falls". Eskimos usually give a name to a particular locality rather than to a certain point of land, or a stream, or a lake. They had no particular interest in naming the falls at this place as it was not a fishing river, being too steep for salmon migration. The small bay into which the river empties, however, is a favourite seal hunting grounds and besides, the lake was a common route of travel across the peninsula. Therefore the area was known as "Kogaluktok", meaning "big falls". Similarly, Netsilik refers to the general locality around the large river emptying out of Netsilik Lake, not in particular to the river or to the lake.

Ross named this river at Kogaluktok Falls the Saumarez River and the body of water from which it flowed, the Krusenstern Lakes, after the Admiral. The party travelled across the ice of this lake and at several places where the lake is constrict-

ed, Ross may have believed that rapids occurred, thus accounting for the plural in the generic. Actually, this lake is at one level throughout and the name has now been adopted as Krusenstern Lake. The native name for the lake (referring probably to one of their camping places on it) is "Tilaugavik", "the place where one fights with one's fists". This corresponds to the name Ross mentions as "Tishagriahui" (p. 534) and to Rasmussen's listing as "tikluarfik" interpreted as above.[1]

Near the western end of Krusenstern Lake, (Figure 13) the report notes a change in topography. Here the party left behind the rugged crystalline rocks and came to the central plain, a low, rather featureless extent of ground moraine and low drumlins, characterized by a surface of limestone rubble and clay. It is probably underlain by level-bedded limestone but outcrops of this rock are scarce and it is unlikely that Ross actually saw exposures at this season along the route they followed. Fraser and Laverdiere in 1953 came across no exposures while traversing this route by canoe in August.

The description of their trip corresponds with the easiest route across the peninsula, following the river to Lake Jekyll (which Ross named), thence westward across the upper arm of that lake to Lake Kangikjuke ("big bay") and then crossing the low divide to Lake Hanstein, also named by Ross. Eventually they arrived at the mouth of the Garry River at Josephine Bay, (Figure 9) which Ross named after the Crown Princess of Sweden. Rasmussen gives the name of these lakes as "Amicoq - the narrow one", of Lake Hanstein as "Tahersuaq" - the big lake", and "Kaner'luk" for the present Lake Kangikjuke,[2] noting that this refers to a lake where there is a caribou crossing place and ruins of Tunit houses. The Boothia natives pointed out the location of the old houses on the map carried by Fraser and Laverdiere. Inuksuks and other signs indicated a caribou hunting area near the east shore of Lake Hanstein.

John Ross returned to the ship by way of Spence Bay and Middle Lake and James Ross continued north along the west coast of Boothia to Cape Adelaide where he determined the position of the magnetic pole. Retracing his route, he followed the coast to Padliakjuk and arrived back at the ship on June 13, his uncle having returned on May 31.

Summary

This was one of the few expeditions of this period which made careful note of the Eskimo names in the area which they explored. No further explorations were made in southern Boothia until recently. By correlating the descriptions and Eskimo names with those obtained in 1953, it was possible to trace Ross' journeys quite accurately in most cases, and credit must be given to the officers of this expedition for their mapping of inland features as well as the coasts. Most of the other expeditions of the past century either mapped coastal configuration only, applying British names liberally without regard to local native nomenclature, or followed the larger rivers leading to the Arctic seas. It must be remembered that the Ross expedition spent three winters in southern Boothia and thereby gained an intimate knowledge of the country. By associating with the local inhabitants, they learned much more about the local geography and the native culture than parties which did not utilize local guides.

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[1] Rasmussen, K., op. cit., p. 95.

[2] Ibid., p. 107.

Appendix

Names adopted by the Canadian Board on Geographical Names as a result of the Geographical Branch Survey of 1953 (Files of the Board, May 6, 1954)

New Names

Netsilik Lake
Garry Lakes
Lord Lindsay Lake
Long Lake
Peregrine Bluff
Kangikjuke Lake
Tukingayak Lake
Akuliakata Point
Sanagak Lake
Kogaluktok Falls
Netsilik River
Garry Falls
Redfish Lake
Canso Lake
Ishluktuk Lake
Angmaluktok Lake
Netsiksiuvik Inlet
Pangnikto Lake
Imilik Island

Name Changes

Krusenstern Lake
Willersted Inlet
Sagvak Inlet

Altered Application

Lady Melville Lake

THE GEOGRAPHICAL BRANCH, 1947-57[1]

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June 5th, 1957, was something of a "red-letter" day for the geographers of Canada. Not only was it the day on which David Thompson, the pioneer geographer, was honoured with the issue of a special postage stamp; not only was it the day on which the Canadian Association of Geographers began its Seventh Annual Meeting in Ottawa but it was also the day, ten years ago, on which the Federal Geographical Branch had its origin.

Very little information on this unit is available in published form. It is mentioned, usually very briefly, in every edition of the Canada Year Book and its principal activities are reported each year in official departmental annual reports. But these are not widely read by geographers. The only general account of the origins of the Branch which had wide circulation was written by its first head, Dr. Trevor Lloyd, and published in the Canadian Geographical Journal.[2] In that article, Dr. Lloyd briefly traced the steps which developed "the need for a government sponsored geographical research centre" and which culminated on June 5th, 1947, in the decision of the Canadian Cabinet to meet this need. I need not recount these events here. This paper continues the story by briefly reviewing the achievements and the evolving organization of the Branch in its first ten years.

The Branch has served under four different ministers of the Crown,[3] and will shortly serve under a fifth,[4] and two deputy ministers.[5] It began as the Geographical Bureau in the Department of Mines and Resources and when that Department was split up in 1950, the Bureau became the Geographical Branch of the Department of Mines and Technical Surveys. It is one of five branches of that Department. The others are the Surveys and Mapping Branch, the Mines Branch, the Geological Survey of Canada and the Dominion Observatories. The Geographical Branch is the smallest of the five. It has a total establishment of 94 employees as compared with 1,617 in the Surveys and Mapping Branch, which is the largest branch in the Department. Its small numbers, however, are not, we hope, any measure of its significance as far as Canadian geography is concerned. Over the past ten years, 258 people have been employed by the Branch. Of course, many of these have been on a seasonal basis but it must be admitted that there has also been a large turnover of professional staff. This has been partly due to the development of geography in Canadian universities and the increasing demand for geographers in business and industry. In competing for geogra-

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[1] Presented at the Seventh Annual Meeting of the Canadian Association of Geographers, Ottawa, 1957, and published with the permission of the Deputy Minister, Dept. of Mines and Technical Surveys.

[2] The Geographical Bureau, Canadian Geographical Journal, XXXVI, 1948, p. 39.

[3] Hon. James A. MacKinnon, 1948; Hon. Colin Gibson, 1949; Hon. James McCann, 1950; Hon. George Prudham, 1950-1957.

[4] Hon. Paul Comtois was appointed August 8th., 1957.

[5] Hugh Keenleyside, 1947-1950; Marc Boyer, 1950 - present.

phers the Branch has often been the loser. This is a healthy process generally speaking but if carried to excess can harm any research organization. In the ten years of its existence the Branch has been headed by no less than five different men. Dr. Diamond Jenness was acting head for a short time in 1947, pending the appointment of Dr. Trevor Lloyd, the first permanent chief. But he stayed only a year from 1948 to 1949. Dr. F. Alcock was part-time acting head while continuing his regular job as Curator of the National Museum of Canada. Dr. J. W. Watson took over in a permanent capacity in 1949 but he resigned in 1954. We should, however, be grateful to these men for their valuable contributions during the Branch's formative years, as indeed we are to the other geographers who have spent time with us. One made the supreme sacrifice. Dr. Donald Kirk was killed in an aircraft accident on July 31, 1950, while carrying out geographical surveys over Alert, N.W.T. He was the only native Canadian geographer ever to enter the Branch with his Ph.D., and his death was a blow to the developing profession. It was by a strange turn of fate that his last resting place should be near the northernmost point of Canadian land.

The purposes of the Geographical Branch are, like those of the Bureau which preceeded it, to collect, organize, and make readily available for the use of all branches of the government, geographical data about Canada and foreign areas of importance to Canada and to prepare studies on specific aspects of the geography of Canada for the use of those engaged in government, defence, business and scientific research.

Reference Services

Some of the data to be collected is already recorded in government documents and in public and private libraries. It may be in manuscript form, in a printed book or pamphlet, in the form of photographs or on published maps. Gradually collections of these materials have been built up in the Branch. The book library now includes over 17,000 volumes, including atlases and gazetteers -- the largest specialized geographical library in Canada. The map library is a source of particular pride as it is unique in Canada and is one of the ten largest in North America. It now consists of over 115,000 sheets from all parts of the world. Much of our foreign material is acquired on an exchange basis. The Branch has book exchanges with 37 overseas countries and map exchanges with 23. The ground photograph library was not established until 1950 but it already contains about 19,000 prints and almost as many negatives and a good Kodachrome transparency collection.

These units are now collectively referred to as Reference Services. (See Figure 1). They are, of course, extensively used by the Branch staff but they are also used by other government departments. Illustrative of this was the loan to the National Research Council of about half of our Japanese and Chinese maps -- some 5,000 sheets during the Korean crisis and the loan of some 8,000 photographs to the Department of National Defence in connection with the construction of the DEW Line. But these collections may also be used by private individuals. For example, Professor Tore Ouren of Norway spent the winter of 1951 in the book library in connection with his research on shipping conditions and trade in Eastern Canadian Ports. Similarly, some years ago, Jean Sarazin spent considerable time in the library in connection with the preparation of a series of broadcasts to Latin-America.

Field Work and Research

But as is well known, much of the geography of Canada has never been investigated or recorded. Thus part of the Branch's work is to "collect" data in the field

When the Branch was formed, plans were "laid for the systematic study along scientific lines of those parts of the country which are still relatively unknown" and this policy is still in effect. Indeed, as if to emphasize this, the Act of Parliament which

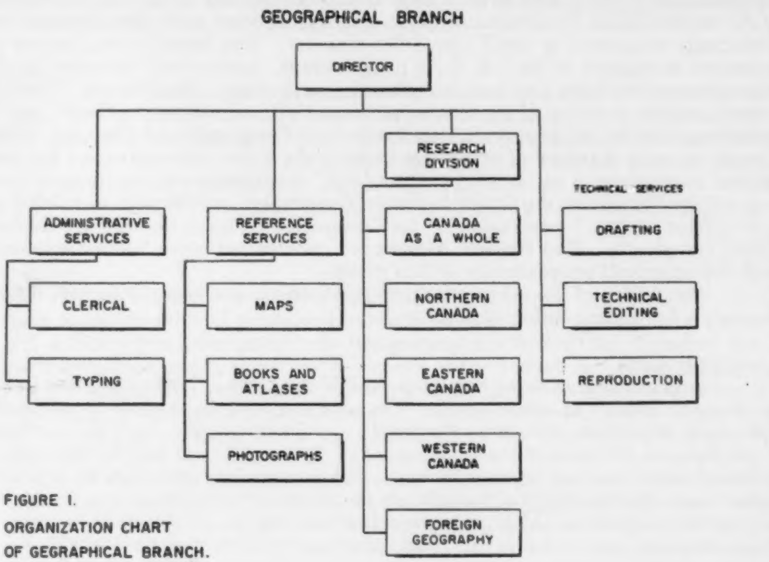

FIGURE I.
ORGANIZATION CHART
OF GEGRAPHICAL BRANCH.

created the Department of Mines and Technical Surveys specifically states that "technical surveys" includes "geographical surveys".[1]

Field investigation and "making readily available" other geographical material calls for research capabilities and our research division is the largest of our subunits. The bases for the field programme and office research are the geographical needs of Canada. These are usually made apparent by or through groups such as committees, commissions, government departments or public institutions. These may be national bodies or international bodies and, of the latter, only those of which Canada is a member, or supports in some other way, are considered in planning the Branch's programme. The needs are weighed in the light of the staff and funds available and steps are taken to meet them through the research programme.

International Co-operation

Since 1947, part of the research programme has been, or is being carried out, in collaboration with three international groups. The first is the United Nations Organization. The Branch is recognized as the co-ordinating agency for Canadian activities in the UNESCO Arid Zone Programme. In addition, it carries out some research itself in accordance with the UNESCO resolution "to promote the co-ordination of research on scientific problems concerning the arid zone -- by collecting and disseminating information on current research and assisting the implementation of

[1] Statutes of Canada, Geo. VI, Cap. 17, 1949.

projects that form part of a systematic programme of basic research". In line with this, the Branch carried out a survey of the Southern Interior Plateau of British Columbia during 1949 and 1950 and is now proceeding with a study of the human adjustments to the aridity in the Prairies. The second of these groups is the International Geographical Union. The Branch acts as the Secretariat of the Canadian Committee of the International Geographical Union which is sponsored by this Association and financially supported by the Federal Government. The Branch also carries out research in support of the I.G.U.'s programmes, particularly those of the I.G.U. Commissions on Land Use and Periglacial Morphology. The Branch Director is a corresponding member of the Commission on National Atlases. Finally the Branch collaborates with the Pan-American Institute of Geography and History. Although Canada is not a member of this organization, the Federal Government has sent official observers to its meetings since 1943, the Director of the Geographical Branch represents Canada on the Commission on Geography, and Branch members are on the committees of this Commission -- the Committee on Land Use and the Committee on Urban Geography. The Branch, therefore, carries out some research in accordance with the approved programmes of this group.

Some idea of the other research in which we are engaged is best described through a few major fields of activity.

Land Utilization

A great deal of work has been done in the field of land utilization in rural areas, wilderness areas and urban areas. The land use work in several of our major cities - Winnipeg, Hamilton, Toronto, Montreal, and Quebec City -- was primarily for the Civil Defence Division of the Department of National Health and Welfare as part of an urban physical characteristics survey. But the results were also invaluable for the urban maps for the Atlas of Canada, in assisting port studies of use to several Federal Government agencies and private organizations and the experiences of conducting these surveys have aided urban geographers in several of our universities.

Urban land use was also investigated on the island of Newfoundland along with other land uses of areas of interest to the Federal Department of Fisheries and the Newfoundland Fisheries Development Authority.

This work is being continued on a more systematic basis in collaboration with the Newfoundland Department of Mines and Resources.

Somewhat similar surveys were made in Nova Scotia and Alberta where the Branch personnel experimented with various approaches to the problem of recording land use as a contribution to the International Geographical Union programme in this field. Finally, some land use mapping has been done in the office by interpreting air photographs and making occasional field checks.

The Atlas of Canada

This project has been widely publicized and has occupied a great deal of our time during the past ten years. The task of preparing a new atlas of the country somewhat comparable to those published by the Department of the Interior in 1905 and 1915 has been, relatively speaking, enormous. Looking back on all that had to be done "starting from scratch", it appears that those responsible for allocating the work to the Branch had no idea of all that was involved. There never seemed to be quite enough staff, or the Branch did not have the staff with the right skills or the staff at the right time, or else the staff required was not available (this was particularly true of draughtsmen). However, progress was gradually made and all but three or four of the 110 sheets are now in the printers hands for the English edition and the covers are being manufactured. Provided no difficulties occur with the tedious and time-consuming process of checking proofs, the English edition should be available some time in 1958 for $18.00. The experience with this project has taught us a great deal and much

of this experience has spread to other parts of Canada. Knowing that a national atlas was being produced encouraged many of the provinces to produce atlases. The best example of this is British Columbia although Ontario has also published one, and Quebec and Manitoba are preparing atlases. Some of the geographers now engaged on the production of provincial atlases "cut their teeth" on the Atlas of Canada during periods of seasonal employment with the Branch.

Terrain Analysis

In 1952, the Branch began a programme of preparing a series of reports on existing detailed information on surface terrain conditions in northern Canada, the aim being to describe all conditions of the surface -- surface deposits and landforms, vegetation and water features. The work was begun by examining all existing sources and, later, analysing these elements. This work is, in a sense, similar to the land use surveys. The main difference is that in the north nature uses the land more than man!

Ice Distribution

In 1947, the Geographical Branch laid plans for a long-range study of northern ice conditions in anticipation of increased surface and air transportation in the Arctic. During 1948, a file of ice information was inaugurated and in 1951 the Canadian Ice Distribution Survey was established. The purpose of the survey is "to extend the knowledge of the formation, extent and movement of the different types of floating ice and the accompanying navigational difficulties". The ice information file is a central pool of data from all government and private agencies on the distribution of ice in the coastal and inland waters of Canada. We have on file some 8,550 cards describing sea-ice conditions that were extracted from books, pamphlets and other data to the end of 1956. Supplementing this, we have carried out actual ice observations. From 1947 to 1953 the Branch had an observer on board a United States ice-breaker on its annual cruise to Arctic waters, and from 1956 onwards a Branch representative has been on board a Canadian vessel sailing to the Arctic. During the winters of 1956 and 1957 Branch officers participated with the Defence Research Board, the Royal Canadian Navy, and the Royal Canadian Air Force in an aerial ice survey of the Gulf of St. Lawrence.

Three general reports by Branch officers on the conditions of ice have been published on Ungava Bay, Hudson Bay, and the Gulf of St. Lawrence in addition to a special report on eastern Arctic ice conditions. In addition there are five special reports in progress.

Much of this work is of assistance in formulating methods of calculating ice potential, and thereby ice forecasting, and in determining the feasibility of year-round navigation.

In addition to major research undertakings, requests are constantly being received for special reports, data and other geographical services which involve the time of the staff for several weeks, days or minutes, depending on its precise nature. Records have been kept of those requests which involved geographers since April 1950 and up to the end of March of this year they totalled 2,950, with the numbers increasing as each year went by. This works out to over 400 a year or an average of almost 2 per working day -- quite considerable when one considers the relatively small staff of the Branch. Many of these enquiries are from individuals from across the country.

Technical Services

To properly carry out its terms of reference, the Branch publishes the results of as much of its research as is possible and occasionally geographical research

sponsored by other Federal Departments. Publication is no simple process, however. Manuscripts have to be edited, maps and diagrams drawn and photographs selected and processed. This is carried out in the Technical Services Division. Since 1947, the Branch has published twelve books -- four in the Memoir Series, two in the Canadian Geography Information Series and six in the Foreign Geography Series. It has established the journal Geographical Bulletin, eight issues of which have appeared which have included 29 reports of research in progress. 17 special bibliographies have been published and 8 Geographical Papers covering a variety of subjects in which we have been involved. Last, and by no means least, the Branch "published" the filmstrip "The Geographical Regions of Canada".

All of the maps and diagrams have been drawn by the staff of the Branch but, in addition, they have also drawn many special maps to illustrate the publications of other departments such as Foreign Trade, published by the Department of Trade and Commerce and External Affairs published by the Department of the same name. The Branch has also assisted with the publications of other departments in a variety of other ways from supplying basic information to collaborating in their actual format and presentation. Not the least of this work has been with the National Film Board.

Administrative Services

This has given, briefly, some account of the three principal parts of the Branch with which geographers are mostly concerned. But Figure 1 shows that there is a fourth unit labelled "Administrative Services". This is made up of the clerical and typing staff which look after field accounts, requisitions for equipment, books, photographs, maps, draughting and office supplied, attendance and other staff records, the typing of reports, the card indexes of our collections and so on. It is impossible to enumerate the multitude of affairs to which this group attends and on whom the well-being of the Branch and the running of its research programmes depend.

Other Activities

This then is the way in which the Branch is now organized and some of the work which it does. But the Branch has also served the discipline of geography in a number of what might be called "unseen" ways.

Members of the Branch have supported many meetings of a professional nature by presenting papers and taking part in technical discussions. The Government of Canada did not take a full part in the work of the International Geographical Union until 1949 when the Branch was represented at the Sixteenth International Geographical Congress in Lisbon. It was also represented at the Seventeenth Congress in Washington in 1952 and the Eighteenth Congress in Rio de Janeiro in 1956. Indeed, the Branch played a significant role in the arrangements for the Canadian delegations to these conferences and in preparing the Canadian map and book exhibits.

At every annual meeting of the Canadian Association of Geographers since its inception in 1951 at least one paper has been presented by a member of the Branch and most of the meetings of the Association of American Geographers are also attended by a member of the Branch. Other contributions of note during the past ten years were made at meetings of the Community Planning Association of Canada, the American Society of Photogrammetry, the Pan-American Institute of Geography and History in Santiago, Chile, and the International Arid Lands Symposium in Albuquerque, New Mexico. Branch members also serve on several Federal Government committees including the Canadian Board on Geographical Names.

In 1948, when the Branch was but nine months old, its then Chief reported that

the Branch was serving as a centre through which geographers in other countries were maintaining contact with Canada and as a headquarters for visiting geographers while in Ottawa.[1] This has continued and the Branch has welcomed a number of distinguished geographers from other lands. To mention but a few, there have been Blanchard of France, Sternberg of Brazil, Stamp, Steel, and Fawcett of England, Caraci of Italy, Wilcock of Australia, Hamid of Indonesia, Tulippe of Belgium, Roberts of South Africa and Khalaf of Iraq. Many visitors came during the UNESCO Seminar on the Teaching of Geography to which Canada played host in 1950 and to which the Branch seconded one of its geographers.

Also, there are very few geographers on the faculties of Canadian universities who have not, at some time or another, joined the staff of the Geographical Branch either to lead one of our field parties or to carry out some special work in Ottawa. It is felt that not only has this helped in the better discharge of the responsibilities of the Branch but it has also aided research in the universities themselves.

The Future

It is anticipated that future development of the Branch will follow along similar lines of the past ten years. It will be continually responsible for revisions and additions to the Atlas of Canada and a French edition has yet to be prepared. But with the bulk of the project finished, it can now turn to the large accumulation of "unfinished business" which had to be put aside in order to accelerate the production of the Atlas, as well as to undertake new work. The results of many of the field investigations of the Branch have either not been processed, or inadequately so, and future field work on terrain and ice conditions still has far to go. With these areas of investigation should be linked the land use surveys to which the activities of the Senate Committee on Land Use have drawn much public attention recently. In this field the Branch has already established good working relations with the Provinces of Newfoundland and Nova Scotia and it is to be hoped that this can be extended to other parts of Canada.

Figure 2. The future Geological - Geographical Building, Dept. of Mines and Technical Surveys.

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[1] Report of the Department of Mines and Resources for the fiscal year ended March 31, 1948, p. 133.

In the office, a great deal of extraction of basic data still needs to be done including elementary geographical facts, so often scorned by the modern geographer. Even the area of Canada is not precisely known and even for a province like Nova Scotia, which has been settled for some three centuries, the Branch discovered recently that the area of fresh water greatly exceeds the present "official" figures.

Not the least of the plans for the future includes moving to a new building. This is already under construction, and Figure 2 is an artist's conception of the finished structure. It will be a huge building, relatively speaking and the Branch will, of course, occupy only a small part of it. Many people have had the experience, when working for the Branch of having to go to one building to take the Oath of Allegiance, to another for topographical sheets, of crossing town to look at air photographs and to yet another building to draw equipment and so on. Eventually, when most of the Department is on one site, much of this will be eliminated and meeting with the researchers in fields allied to geography will also be facilitated.

But in all that the Branch plans to do, as, indeed, in all that it has done, much depends on the attitude of geographers outside it. Whether they are in university, business, industry, school or "private practice", it is hoped that co-operative efforts will continue to be developed to the mutual advantage of knowing Canada "from the ground up".

SHORTER COMMUNICATIONS - BREVES COMMUNICATIONS

Geography in Education

During the Seventh Annual Meeting of the Canadian Association of Geographers a successful panel discussion on Geography and Education was organized and chaired by Dr. J.L. Robinson of the Department of Geography, University of British Columbia. The panel was as follows:-

Mr. Wilfred Stone, Head, Geography Department, Teachers Training College, Ontario Department of Education, Toronto, speaking on "Geography in Ontario Elementary Schools".
Miss Winnifred Prestwick, Geography Department, Havergal College, Toronto, speaking on "The development of Geography courses in Grade 11-13 in Ontario".
Mr. William Sager, Geography Department, Humberside Collegiate, Toronto, speaking on "Some problems facing a Geography Teacher".
Mr. James Hamilton, Geography Department, Forest Hill Collegiate, Toronto, and Critic Teacher for the Ontario College of Education, speaking on "Audio-Visual Aids in the Teaching of Geography".
Dean Neville Scarfe, Dean, College of Education, University of British Columbia, Vancouver, speaking on "Geography in a Social Studies programme".

Messrs. Stone and Hamilton and Miss Prestwick are all Past-Presidents of the Ontario Geography Teachers Association and Mr. Sager is Vice-President of the Association at the moment.

N. L. Nicholson

Third International Union Association of Geography Teachers

Professor Robert Garry of the University of Montreal attended the Third International Union Association of Geography Teachers at Grenoble from August 26th to 31st. He was Chairman of one of the general assemblies held on August 29th.

B. Cornwall

The Preparation of the Atlas of British Columbia[1]

In the production of the Atlas of British Columbia the facilities of government, university, and industry were integrated under the auspices of the B.C. Natural Resources Conference -- an independent, voluntary organization whose prime purpose is to promote integration and co-ordination of resource development in the province. Within this organization an Atlas committee was set up which included three geographers (two from the University of British Columbia and one from the B.C. Lands Service) as general and cartographic editors.

The first task of the committee was to develop the initial planning phase which consisted of six basic items -- contents, base maps, size, format, binding and cost. Only the criteria controlling the contents are dealt with here. The overall organization

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[1] Summary of a paper presented at the Seventh Annual Meeting of the Canadian Association of Geographers, Ottawa, 1957.

of the Atlas was designed to reflect the resource-based interests of the Conference and, at the same time, provide a reasonably well-rounded presentation of the physical and human geography of British Columbia. The selection of the specific maps in each part was the result of a compromise between what information would illustrate most effectively the outstanding features of the various topics and what amount and type of data it was possible to analyze in the time available. Final decisions were based upon detailed discussion between the editors and the professional groups concerned.

In passing from the planning to the preparation phase, two items became of paramount importance (1) obtaining financial support and (2) programming and maintaining a regular flow of copy to the lithographers. The British Columbia Atlas of Resources had virtually no cost charged against it for professional fees since the planning, compiling, and editing was carried out voluntarily. The non-professional costs of draughting, lithography, and binding were, nevertheless, substantial and were provided for initially by a loan from the Provincial Government. For the maintenance of a flow of material into the lithographer, allocation and completion schedules were drawn up and standards for map and text page compilation finalized. Once the decisions concerning the actual contents of any map or text had been decided upon between those responsible for its preparation and the editors, the data had to be gathered and analyzed to make it suitable for cartographic presentation. When this was completed rough compilation on standard base maps was undertaken by the responsible agencies. The large number of different people compiling maps precluded the possibility of each being able to prepare final copy acceptable to the lithographers for reproduction. Instead compilers produced copy incorporating the final decisions of the cartographers but only at a preliminary standard of draughting. The cartographic editors moulded all the variables entering into map design around a frame work determined by available reproduction methods and the cost involved. Initial cartographic judgments were, of course, made in early stages of the preparation of each map but the final decisions were reserved until the preliminary draughting was commenced. At this stage, manuscript maps were thoroughly reviewed from a content and design point of view and detailed instructions prepared in order that the final draughtsmen could interpret the cartographers' decisions as closely as possible.

When the preliminary draughting was completed and the final cartographic instructions written, the preparation phase was ended and the production phase commenced. This included three very closely related stages -- final draughting, reproduction, and lithography. For the final draughting, a draughting unit was assembled with a geographer as section head and commercial art students as staff. This unit of 4-5 persons carried out all the final draughting of separations for the majority of the maps in the atlas over a 9 month period. The necessity of establishing the closest contact between the final draughting and the reproduction lithographic stage resulted in the draughting unit being attached to the lithography company. The materials used and practices followed may be summarized as follows: (i) Base Maps: Copies of the base map at draughting size were made on film and used under the separation overlays as required. The grid was available separately and dropped in during photography. (ii) Separations: The material chosen for separations had to have both a high transparency and stability. Astrafoil was finally chosen as the most suitable material. (iii) Pens: Although a variety of pens and equipment was used, line weights were specified by the cartographers in terms of the various Graphos nibs which were used as the occasion demanded. (iv) Inks: Ordinary India inks flaked off the Astrafoil surface so that Pelican Special "S" ink was used throughout. However the limited experience of the draughting staff with the line and symbol work of mapping, encouraged the development of alternative techniques. (v) Lettering: In order to provide speed, standardization and range of face and size, trans-adhesive 'stick-up' lettering was used throughout. (vi) Symbols: Again in order to provide speed and standardization, symbols were first

drawn up and then reproduced in large numbers either on filmstrip or on trans-adhesive. Despite extensive experimentation with adhesives, considerable difficulty was experienced in obtaining any permanence with the filmstrip. Consequently the emphasis was upon trans-adhesive, both the standard non-flexible variety and that on flexible material for line work and line symbols (e.g. road and rail routes). (vii) Colour: Colour separations were produced in one of two ways. Most frequently solid black opaquing (requiring screening during photography) was used, but several maps were made using fluorographic greys mixed to various intensities. These latter proved difficult to apply and had a tendency to flake off in a relatively short time after application.

When the separations were completed and checked, they were forwarded for photography. The film positives which resulted from this were checked and, where necessary, corrected by members of the reproduction department. Then colour proofs were made for final checking by the editors. While it was obviously necessary to have proofs of each map page, the type of proof was another matter. While press proofs provided excellent opportunities for final checking, any resulting corrections involved substantial costs since new plates would usually have to be made. Consequently it was necessary to use some process which provided a copy of what was essentially the finished map but yet did not involve plate-making and press running. This process was the Astrafoil colour proof process which provided a print on which the colours and other material were very close to the lithographed map at a fraction of the cost of a press proof. A colour proof of this type was made for each map page and, after the final check and completion of corrections, plate making was commenced.

In order to realize the greatest benefit from the large two colour press available, the map pages were assembled in forms of four in such a manner as to bring those maps using the same colour combinations together on one form. This required very careful planning which influenced the scheduling back to the draughting stage, but avoided additional runs through the press.

J.D. Chapman

Notes sur les formes périglaciaires de la région de Mould Bay[1] Archipel Nord-Canadien.

Le relief de la région de Mould Bay consiste essentiellement en une surface tabulaire dont la hauteur moyenne est de 600 pieds. Cette surface est disséquée, près des rivages, en courtes mais profondes vallées taillées dans des grès et des schistes du Secondaire. Par son climat, la région de Mould Bay appartient au domaine périglaciaire actuel. Les processus dus au gel y rendent possible l'élaboration de formes proprement périglaciaires dont on fait ici un inventaire descriptif. Certaines de ces formes se distinguent par un ou plusieurs caractères des formes antérieurement étudiées. L'équiplanation périglaciaire semble être l'agent principal de l'aplanissement des surfaces élevées de la région.

R. Robitaille

5th International Congress of Quarternary Studies

Professor Louis-Edmond Hamelin, Director, Institute of Geography, Laval University, represented the Canadian Association of Geographers at the 5th

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[1] Resumé d'une communication presentée a la septième réunion annuelle de L'Association Canadienne des Géographes, Ottawa, 1957.

International Congress of Quarternary Studies, University of Barcelona. While in Spain, Professor Hamelin participated in excursions to the Pyrenees, the Sierra de Gredos and the Tage Basin.

B. Cornwall

Non-Urban Recreation as an Element of Urban Geography[1]

Non-urban recreation is defined as "recreation that takes place on publicly owned lands located beyond the corporate limits of a city". This type of recreation has become increasingly popular in recent years.

Studies in British Columbia indicate that the use of rural recreational resources by urban residents is far out of proportion to their importance in the total population. Urban residents made up 68% of the Provincial population at the 1951 census. Urban residents made up nearly 95% of the total number of visitors at four major Provincial Parks in southwestern B.C.

Even if the urban population of the Census Divisions in which the parks are located or adjacent to is considered the proportion of urban visitors to parks is still greater than the proportion of urban residents in the population. Census Division 4 (for the first two parks) is 83% urban, and Census Division 5 (for the second two) is 63% urban.

When these visitors are asked why they visit these non-urban recreation areas 70% indicate it is to get away from the urban environment. Thus it appears that escape from the city is a part of urban geography which requires a great deal more study. We need to know more about the why of the movement. What is there in the urban environment that causes people to seek a relief in rural areas? To what extent is this movement characteristic of urban population - does it affect only a minority of people or does it affect a majority? There is evidence to suggest that certain age groups within the city are more attracted to non-urban recreation than are other age groups. A preliminary study of Greater Vancouver and Greater Victoria would seem to indicate that certain parts of a city are more affected than others.

Use of non-urban recreational resources by urban residents is an important fact of urban geography that has been somewhat neglected by geographers. Everyone who lives in or near a city must be aware of the tremendous migration to and from a city on holidays, weekends, and during the vacation season. There is a circulation of people and vehicles which is becoming an important facet of modern urban life. Whether looked at from the social or economic point of view, this circulation pattern is an essential part of urban geography and should be instituted in any study of an urban area. It also should be worthy of independent study.

If we are to thoroughly understand the geography of urban areas, geographers would do well to study this recreational migration and attempt to give it its true place in the essential characteristics of a city.

Gordon D. Taylor

Geographers in business and industry

With the current increasing emphasis on long-range planning geographers are being gradually absorbed into the fields of market research and industrial location. In order to acquaint their professional colleagues with the problems confronted by the geographer in business, a panel of five business geographers were invited to

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[1] Abstract of a paper presented at the Seventh Annual Meeting of the Canadian Association of Geographers, Ottawa, 1957.

express their views on various aspects of their vocation, during the Seventh Annual Meeting of the Canadian Association of Geographers. The members of the panel were Dr. Marjorie Findlay, Location Analyst with Steinberg's (a supermarket chain in Quebec and eastern Ontario) Montreal; Dr. John Jenness, Research Director for the Regional Industrial Corporation, Pittsburgh; Mr. Leonard Prior, Research Director for McConnell Eastman and Co., Ltd. (an advertising agency), Toronto; Mr. Keith Setter of the CNR Department of Research and Development, Montreal; and Dr. Kenneth Walter of the Business Research Group, Imperial Oil Ltd., Toronto. The panel was chaired by Dr. N. L. Nicholson of the Geographical Branch, Ottawa.

Probably the most important point made was the need to introduce the businessman to the practical value of geography. Without exception, the panel members explained that they owned their jobs, not to their being geographers, per se, but to their training in research techniques and economics, or to previous business experience. This situation led to the use of a variety of occupational titles designed to be more meaningful to the businessman. It is significant that, when businessmen were shown examples of the geographer's work, they immediately showed interest, and it was to this approach that two of the panel owed their jobs.

The panel was enthusiastic about the way in which a training in geography equipped one to pursue useful studies in market research. It was suggested, however, that a good knowledge of statistics was a definite advantage, besides an acquaintance with the applications of electronic data processing. The provision of more specialized studies in business geography is necessary, it was stated, in order to provide the student and businessman with material of more direct value.

Each panel member, in describing his or her specific job, noted that it was a detailed knowledge of the significant factors in a given area, and the ability to relate them in a meaningful and useful way, which set the geographer apart from the non-geographer. The broad geographic approach usually accounted for the human element not included in a cold, strictly quantitative, analysis. One interesting remark was to the effect that, in some cases, engineers were doing tasks which were admirably suited for geographers. The simple talent which particularly impressed one employer was the geographer's ability to use a map! While the panelists did not suggest that geography offered a panacea for all the problems of market research, it is encouraging to observe that their experiences generally indicated that, in their particular jobs, they were especially well-qualified for the research tasks assigned to them. Even in a purely complimentary role it seems that the geographer has something concrete to give the businessman.

The prospects of business geographers will certainly improve with the industrial growth of Canada, but the geographer might well encourage this trend by advertising his wares in the form of pertinent articles in business journals and popular magazines. (See, for example, McDaniel, Robert: You can use a geographer in your business planning; Canadian Business, 29, 6, 1956, pp. 40-44). It may be expected that an improved and extended geography programme in Canadian schools will also serve this purpose.

Robt. McDaniel

Women in Science and Engineering

A Report on Women in Science and Engineering published by the Technical Personnel Unit, Economics and Research Branch, Department of Labour, Ottawa in September, 1956 is of interest because it includes geographers. It is based on the records of 830 women who received their Bachelors Degree prior to 1952 and completed questionnaires for the Technical Personnel Register of the Canadian Department of Labour. The report shows that 16 of the 830 women are geographers. The

<u>total</u> number of geographers (men and women) on the Register is 128 which means that women form 12% of the professional geographer force of the country. This is higher than for any other group except biology, for which the proportion is 23%. (By an interesting coincidence, there are as many women geologists as there are women geographers but the women geologists make up only 2% of the total for their profession). Of the 16, 11 claim specialisation in research, one in development, one in designing and draughting and two in teaching and writing but six are actually employed in government, four in teaching and the remainder are self-employed or their employment is not specified.

N.L. Nicholson

THE CANADIAN ASSOCIATION OF GEOGRAPHERS

Seventh Annual Meeting

The Seventh Annual Meeting of the C.A.G. was held in Ottawa from June 5 to 8, 1957. This was the longest meeting ever arranged by the Association and with a registration of over 100, it was also the best attended. The University of Ottawa was the host but one morning session was held at Carleton University.

The assembly was greeted by Rev. R. Lavigne, O.M.I., Dean of the Faculty of Arts, University of Ottawa; Dr. James Gibson, Dean of Arts, Carleton University; and Dr. William van Steenburgh, Director-General of Scientific Services, Department of Mines and Technical Surveys. The remainder of the first morning was devoted to papers on historical geography and the afternoon was spent in visiting either the Army Survey Establishment or the Public Archives and National Museum or Canadian Aero Surveys, Limited. On the morning of the second day, six papers were presented and discussed on physical, economic and mathematical geography before the annual business meeting at which the election of Dr. Trevor Lloyd, Chairman of the Department of Geography, Dartmouth College, New Hampshire, as President for 1957-58 was announced. The afternoon was again spent on excursions to either the Dominion Experimental Farm or the Dominion Observatory and National Air Photo Library. The Presidential address was given in the evening. The morning of Friday, June 7, was devoted to geography and planning and urban geography. It concluded with a special address by Walter B. Bowker of the Federal District Commission and in the afternoon an extensive 5-hour field trip was made within the national capital region. Some 70 participants investigated such diverse features as Rideau Falls, new housing developments, the Gloucester Fault and

L'ASSOCIATION CANADIENNE DES GEOGRAPHES

Septième Réunion Annuelle

La septième réunion annuelle de l'A.C.G. a été tenue à Ottawa du 5 au 8 juin 1957. Elle a été la réunion la plus longue jamais organisée par l'association et avec un enregistrement d'au delà de cent membres elle a été la mieux suivie. L'Université d'Ottawa était notre hôte, mais une réunion du matin fut tenue à l'Université Carleton.

Le R.P. René Lavigne, o.m.i. doyen de la Faculté des Arts de l'Université d'Ottawa le docteur James Gibson, doyen de la Faculté des Arts de l'Université Carleton et le docteur William van Steenburgh, directeur-général des Services Scientifiques du Ministère des Mines et Relevés Technique ont tour à tour souhaité la bienvenue à l'assemblée. Le reste de la matinée a été consacré à des communications sur la géographie historique et l'après-midi à des visites organisées aux endroits suivants; les établissements des Relevés Topographiques de l'Armée, les Archives Publiques, le Musée National, et la compagnie Aero Surveys Limited. Dans l'avant-midi de la deuxième journée, six communications furent présentées et discutées sur différents aspects de la géographie physique, économique, et mathématique. A la réunion annuelle des affaires de la société qui suivit, le docteur Trevor Lloyd, directeur du Département de Géographie au Dartmouth College, New Hampshire, fut proclamé à la suite d'une élection, président de l'association pour l'année 1957-58. Des excursions furent organisées pour l'après-midi à la Ferme Expérimentale, à l'Observatoire du Dominion, et à la Photothèque nationale de l'air. Le discours présidentiel fut donné dans le soirée. Le vendredi matin 7 juin, a été consacré à la géographie urbaine et à l'urbanisme. La réunion se termina par un discours de monsieur

the old portage around Little Chaudière Rapids.

Programmes of films on Canadian geography were arranged for the evenings of June 5th and 7th. The first was by the courtesy of Crawley Films, Limited. The second was arranged by the National Film Board and was introduced by Mr. John Webb, their Education Officer, who provoked a lively discussion at the conclusion of the session.

The programme on Saturday was also unique. The morning session included two panel discussions -- one on geography in education and another on geographers in business and industry. The afternoon session was devoted to geography in the Federal Government during which several senior Civil Servants, whose work is of interest to geographers, gave talks. R.A.J. Phillips of the Department of Northern Affairs and National Resources spoke on problems of northern administration; Dr. C.C. Lingard of the Dominion Bureau of Statistics spoke about the services of the D.B.S.; Dr. T. J. Blachut of the National Research Council gave some account of recent developments in mapping methods; Mr. Ivor Bowen, Director of the Joint Intelligence Bureau, Department of National Defence, spoke about geography and national defence; Dr. N.L. Nicholson reviewed the activities of the Geographical Branch, Department of Mines and Technical Surveys, during the first ten years of its existence.

The First Association Dinner

The proceedings of the Seventh Annual Meeting terminated with a dinner at which the C.A.G. prizes for 1957 were awarded to the following: Miss Elizabeth Firstbrook (Toronto); James R, Gibson (British Columbia); J.R.

B. Bowker de la commission du District Fédéral et dans l'après-midi qui suivit une excursion de 5 heures fut entreprise dans les régions voisines de la capitale nationale. Quelques 70 excursionistes ont étudié divers aspects de la géographie de la région, notamment les chutes Rideau, la faille de Gloucester, les portages historique des rapides Chaudières, ainsi que quelques nouveaux projets d'habitation. Des représentations cinématographiques étaient à l'agenda des soirées du 5 et 7 juin. La première était une courtoisie de Crawley Films Ltée., et la seconde organisée par l'Office National du Film avait pour commentateur, John Webb de cet organisme, celui-ci suscita une discussion des plus intéressante à la fin de la représentation. Le programme du samedi matin comprenait deux panel, le premier sur la géographie dans le domaine de l'éducation et le second sur le rôle des géographes dans l'industrie et le commerce. A la réunion de l'après-midi, consacrée à la géographie dans les différents ministère fédéraux, quelques hauts fonctionnaires dont le travail est lié à la géographie présentèrent de brèves communications. R.A.J. Phillips du Ministère des Affaires du Nord, parla des problèmes d'administration dans le Grand Nord canadien. C.C. Lingard du Bureau Fédéral de la Statistique entretint l'auditoire du travail de son organisme et T.J. Blachut du Conseil National des Recherches donna un Bref aperçu des dévelopements récents dans le domaine de la cartographie. Ivor Bowen, directeur du Bureau Conjoint des Renseignements parla de la géographie et de la défence nationale tandis que N.L. Nicholson passa en revue les activités de la Division de la Géographie durant les 10 premières années de son existence.

Le premier diner de l'Association

Les activités de la septième réunion annuelle se terminèrent par un diner, pendant lequel les prix de L'A.C.G. pour l'année 1957 furent décernés aux personnes suivantes; Mlle Elizabeth Firstbrook (Toronto); James R. Gibson (Colombie

Harrington (Alberta); Philip Keddie (Manitoba); Claude Roberge (Laval); W.G. Ross (McGill); Miss Diane Thomson (McMaster); Robert Viau (Montreal); Marc Watson (Ottawa); Miss Carol Young (Western Ontario). The prize given was a copy of Atlas des formes du relief.

The guest speaker for the occasion was Dr. Marc Boyer, Deputy Minister of the Department of Mines and Technical Surveys. His address was entitled: "Alberta Gas to Eastern Canada".

Britannique); J.R. Harrington (Alberta); Phillip Keddie (Manitoba); Claude Roberge (Laval); W.G. Ross (McGill); Mlle Diane Thomson (McMaster); Robert Viau (Montréal); Marc Watson (Ottawa); Mlle Carol Young (Western Ontario). Le prix offert était un exemplaire de "l'Atlas des formes du relief".

L'orateur invité pour cette occasion était le docteur Marc Boyer, sous-ministre du Ministère des Mines et Relevés Techniques. Sa conférence était intitulée: "Le gas de l'Alberta dans l'Est canadien".

Dr. Boyer first paid tribute to Canadian geographers, "a growing profession with an ever increasing task to accomplish, in a country striving to achieve full maturity against so many geographical, political and economic odds." He described the advent of Alberta gas to Eastern Canada as one of the most challenging and most important national projects since Confederation. The length of the Trans-Canada pipeline - 2,300 miles - was such that it would reach, if in Europe, from Lisbon to Moscow or from London to the Suez Canal.

The continuing development in the densely populated and industrially developed areas in Ontario and Quebec could only be accomplished with more energy being made available. The arrival of Western natural gas was a timely event in this high-cost, fuel-deficient area. While natural gas presently accounted for only 6% of the energy consumption in Canada, recent studies indicated that this would increase to possibly 25% in the next two decades. The same had happened in the United States of America where it had grown from 7% to 26% of total energy consumption in the last fifteen years.

With natural gas from the West, Ontario and Quebec's dependence on American coal would be substantially reduced. This saving in imports, in Central Canada, would amount to at least $25,000,000 annually. The Trans-Canada pipeline will sell to distributors in Saskatchewan, Manitoba, Ontario and Quebec, which distributors in turn could service a potential clientele ranging between 6 and 7 million people.

After explaining the factors bearing on the economics of the Trans-Canada pipeline project: supply, markets, finance, terrain, governing legislation, etc., Dr. Boyer traced the history of the Trans-Canada Pipe Lines Company project since its inception in 1948. He described the 1948-52 period as the trial years, 1953-55 as the key years and 1956 as the epochal year. The years 1956-58 would be taken up by the construction programme, with an expected completion by the fall of 1958.

Dr. Boyer, in closing, referred to Canada having been described as "the triumph of imagination over geography". "Imagination", he said, "meant enterprise and ingenuity, but more important yet", he added, "was the freedom we enjoyed in our Country to exercise these qualities". "Such freedom", he concluded, "is the keynote to prosperity, progress and good living."

Dr. Boyer's address was followed by the showing of a film entitled "Trans-Canada Pipe Line", which had graciously been forwarded for the occassion by the Trans-Canada Pipe Lines Limited, after which Dr. B. Brouillette, as Chairman of the Canadian Committee of the International Geographical Union, concluded with these remarks:-

Le discours que nous venons d'entendre mérite d'être considéré comme une des meilleures communications faites durant la septième réunion annuelle de l'Association canadienne des géographes. Son auteur est particulièrement qualifié pour

traiter d'un tel sujet: il est à la fois un homme de science, doublé d'un administrateur. Le problème que M. Marc Boyer nous a exposé est un des plus importants de l'heure actuelle pour l'avenir économique du Canada; il ne peut donc pas nous laisser indifférents, et il intéresse non seulement les géographes-économistes, mais aussi les géomorphologues, se préoccupant de la structure du sous-sol, un des problèmes fondamentaux dans la recherche du pétrole et du gas naturel.

Toutefois, nous devons être reconnaissants envers M. Marc Boyer, non seulement pour l'apport scientifique de sa contribution. Personne d'entre nous n'ignore le rôle capital joué par le ministère des Mines et relevés techniques dans l'organisation et la poursuite des recherches géographiques au Canada. Ce rôle a été souvent évoqué au cours de ce Congrès, ainsi que durant les précédents, et je puis vous affirmer, sans dévoiler de secret, que l'attitude du sous-ministre des Mines et relevés techniques, une attitude compréhensive et sympathique à l'égard des géographes, est essentielle aux progrès de la géographie dans le Canada entier. La meilleure preuve nous est fournie par la liste des travaux exécutés chaque année et dont vous trouverez tous les détails dans le rapport annuel du ministère. Mais, il y a plys: au moment ou le Service géographique célèbre le dixième anniversaire de sa fondation, il est particulièrement opportun que l'Association canadienne des géographes se soit réunie ici, dans la capitale fédérale. Nous avons pu ainsi mieux nous rendre compte de l'organisation du Service géographique que notre collègue, le Dr Norman Nicholson, dirige avec tant de compétence, et cela, après la remarquable exposé qu'il vient de nous faire à la séance de cet après-midi.

Mercredi dernier, au moment où s'ouvraient les délibérations du Congrès, nous avons été reçus non seulement par le Vice-Recteur de l'Université d'Ottawa et par un Doyen de l'Université Carleton, mais en outre par le Directeur général des Services scientifiques du Ministère des Mines et relevés techniques, le Dr William van Steenburg. Ce geste nous prouve que la géographie a cessé d'être une "parente pauvre" parmi les disciplines scientifiques dans l'administration fédérale.

Enfin, dans l'assistance aux séances d'étude du Congrès et aux excursions, nous avons vu un plus grand nombre de jeunes gens et de jeunes filles que d'ordinaire, et c'est grâce à votre obligeance, M. le sous-ministre, que nous devons cela. Vous avez permis aux étudiants de nos universités, auxquels vous offrez de nombreux postes en été, de participer à nos délibérations.

Je tiens, en terminant, à attirer l'attention des auditeurs sur l'importante place que la géographie économique a prise durant le Congrès qui se termine ce soir. Notre président sortant de charge, le Dr Pierre Camu, nous a démontré dans son intéressant discours tout l'intérêt qu'un géographe peut apporter à la solution d'un problème économique d'envergure nationale. Nous avons eu ce matin une séance sur le rôle des géographes dans les affaires et dans l'industrie, dont tous ceux qui y participèrent, se souviendront.

Enfin, la journée se termine magnifiquement, M. le sous-ministre, par votre allocution, dont je ne saurais dire trop de bien.

J'ai le plaisir et l'honneur de me faire ici l'interprète de tous ceux qui sont présents pour vous féliciter chaleureusement, et vous remercier d'avoir accepté, malgré vos multiples obligations, d'être des nôtres ce soir.

Constitution of the Canadian Association of Geographers

ARTICLE I - Name

The name of the organization shall

Constitution de L'Association Canadienne des Geographes

ARTICLE I - Nom

Le nom de l'organisation sera

be "The Canadian Association of Geographers," and in French "L' Association Canadienne des Géographes".

ARTICLE II - Objectives

The objectives of this Association shall be to promote geographical study and research.

ARTICLE III - Membership

1. There shall be four kinds of members:-

a. Members Full membership in the Association is open to all persons (i) with a graduate degree in geography (ii) with an undergraduate degree with honours in geography and who are now employed as full-time geographers, (iii) who have made significant contributions in the field of geography.

b. Associate Members Persons who are actively interested in the aims of the Association but who do not have the qualifications for full membership may become Associate Members.

c. Student Members Full-time college or university students interested in the objectives of the Association may become Student Members.

d. Benefactors Any person, institution or corporation wishing to demonstrate interest in the objectives of the Association by making a donation of $500.00 or more, shall upon application to the Secretary and approval of the Executive, be granted the title "Benefactor".

2. The dues for the various classes of membership, life membership, and husband and wife membership shall be fixed by the Executive Committee.

3. Applications for Membership shall

"L' Association Canadienne des Géographes"; dans sa traduction anglaise "The Canadian Association of Geographers".

ARTICLE II - But

Le but de cette association sera d' encourager l' étude et la recherche géographiques.

ARTICLE III - Membres

1. L' association comprendra quatre catégories de membres:

a. Les membres actifs Pourra être membre actif de l' A.C.G. toute personne (i) titulaire d' un diplôme universitaire en géographie; (ii) titulaire d' un baccalauréat-ès-Arts avec spécialisation en géographie et employée à plein temps à titre de géographie; (iii) qui s' est signalée dans le domaine de la géographie.

b. Les membres associés Les personnes intéressées d' une manière active aux buts poursuivis par l' A.C.G., mais qui ne sont point éligibles à la première catégorie (a), peuvent devenir membres associés.

c. Les membres étudiants Les étudiants des degrés secondaires et universitaires intéressés aux buts de l' A.C.G. peuvent devenir membres étudiants.

d. Les bienfaiteurs Toute société, institution ou personne désireuse de manifester son intérêt aux buts de l' A.C.G. en lui faisant donation d' au moins $500.00, se fera décerner, après demande dûment faite au secrétaire et approuvée par le conseil exécutiv, le titre de "bienfaiteur".

2. Les cotisations pour les catégories de membres ci-haut mentionnées, les membres à vie et les membres conjoints (époux et épouses) seront établies par le conseil exécutif.

3. Le comité des membres étudiera attentivement les candidatures qui lui seront soumises et décidera de la catégorie de membres à laquelle le candidat

be scrutinized by a Membership Committee, which shall decide the type of membership to which an applicant is eligible.

ARTICLE IV - Officers and Committees

1. The elected officers of the Association shall be a President, a Vice-President, a Secretary, a Treasurer and an Assistant Secretary. At least one officer shall be English-speaking and another officer French-speaking.

2. The business of the Association shall be transacted by an Executive Committee and committees appointed and sponsored by it. The Executive Committee shall be composed of the officers in article IV-1, the immediate past president and 6 elected Councillors. To broaden representation on the Executive Committee, it may appoint two additional Councillors to serve for one year. Four shall be a quorum at Executive Committee meetings.

3. The term of office for the officers for the officers shall be one year and for the elected Councillors three years. Two Councillors will retire each year. The President, Vice-President, and Councillors will not be eligible for immediate re-election to the same office.

4. The Editor of the Canadian Geographer shall be appointed by the Executive Committee.

5. Two auditors shall be appointed annually at the Annual General Meeting to audit the accounts of the Association for the current financial year (January 1 - December 31).

ARTICLE V - Meetings

1. A general Meeting shall be called during the Annual Meeting which shall be held if possible in the same period and at the same place as the other Learned Societies of Canada.

est admissible.

ARTICLE IV - Bureaux et Comités

1. Les officiers élus du bureau de l'association comprendront un président, un vice-président, un secrétaire, un trésorier et un assistant-secrétaire. Au moins un de ces officiers élus devra être de langue anglaise et un autre de langue française.

2. Les affaires de l'association seront traitées par un conseil exécutif et des comités nommés par lui. Le conseil exécutif sera composé des membres du bureau mentionnés à l'article IV-I, du président sortant de charge et de six conseillers élus. Afin d'augmenter la représentation au sein du conseil exécutif, celui-ci peut nommer deux conseillers supplémentaires avec mandat d'un an. Le quorum des réunions du conseil exécutif sera de quatre membres.

3. La durée du mandat des membres du bureau sera d'une année et, pour les conseillers élus, de trois and. Deux conseillers prendront leur retraite à chaque année. Le président, le vice-président et les conseillers ne seront seront pas immédiatement rééligibles aux mêmes postes.

4. Le conseil exécutif nommera le directeur de la revue "Le Géographe Canadien".

5. Deux vérificateurs seront nommés chaque année durant l'assemblée annuelle générale pour vérifier les comptes de l'association pour l'année fiscale en cours (1er janvier au 31 décembre).

ARTICLE V - Assemblées

1. Une assemblée générale sera convoquée durant l'assemblée annuelle qui se tiendra si possible à la même époque et au même endroit que celles des autres Sociétés Savantes du Canada.

2. All members shall be given two months' notice of these meetings.

ARTICLE VI - Voting and Election

1. Constitutional Changes.

a. Any proposed change in the Constitution may be submitted to the Secretary by a Full Member, if he has the support of five Full Members. The Secretary will circulate the proposed change to the membership.

b. Ratification of changes in the Constitution requires the approval of two-thirds of all Full Members in good standing replying to the ballot circulated by the Secretary.

2. All business at the Annual General Meeting shall be settled by a simple majority of all members present and voting.

3. A Nominating Committee composed of the three immediate Past-Presidents shall ask for nominations and with the Secretary shall conduct elections by mail three months before the Annual General Meeting.

ARTICLE VII - Regional Committees

Any group of members in any region may set up a Regional Division of the C.A.G. upon ratification of the proposed Constitution of the Division by the Executive Committee.

Regional Divisions shall receive on request financial assistance from the Association up to a maximum of 10% of the total annual membership fees paid by members residing in that region.

2. Tous les membres seront avisés deux mois avant de la tenue de chacune des assemblées.

ARTICLE VI - Vote et élections

1. Amendements à la constitution:

a. Toute demande d' amendement à la présente constitution, pourra être soumise par un membre actif à condition qu' elle ait été appuyée par cinq autres membres. Le secrétaire fera connaître aux membres l' amendement proposé.

b. Pour être inclus dans la constitution, l' amendement doit être approuvé par les deux tiers de tous les membres actifs reconnus répondant au scrutin distribué par le secrétaire.

2. A l' assemblée générale annuelle toutes les affaires seront réglées par la majorité absolue de tous les membres présents et votant.

3. Un comité de nomination composé de trois présidents immédiatement sortant de charge établira les candidatures et, avec le secrétaire, tiendra les élections par courrier tois mois avant l' assemblée générale annuelle.

ARTICLE VII - Comités régionaux

Tout groupe de membres peut dans une région quelconque former une division régionale de l' A.C.G. sur ratification, par le comité exécutif, de la constitution proposée de cette division.

Les divisions régionales recevront sur demande un secours financier de la part de l' association jusqu' à concurrence de 10% du total des cotisations annuelles payées par les membres qui résident dans cette région.